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Connecting Environmental Stewardship, Youth Development, And Community Engagement, Through A Student-Centered Pollinator Curriculum

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CONNECTING ENVIRONMENTAL STEWARDSHIP, YOUTH DEVELOPMENT, AND COMMUNITY ENGAGEMENT, THROUGH A STUDENT-CENTERED POLLINATOR CURRICULUM

by

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"By tackling problems and serving real needs within the community, students begin to see that their own decisions and actions can help to improve the quality of life for all"

~ Mary Haque

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ABSTRACT

Huerta Ortiz, E. Connecting Environmental Stewardship, Youth Development, and Community Engagement, through a Student-Centered Pollinator Curriculum (2017)

The goal of this capstone was to find the means to engage inner city youth in outdoor experiences that would help them form a deep connection to nature. The research question that I focused on was: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? The analysis of the literature review guided me to find one possible answer, which is to develop and implement a student-centered pollinator curriculum in partnership with the national parks, native plant nurseries, and school districts. The pollinator curriculum is founded on four important elements: student-centered pedagogy, relevant science content, positive youth development, and community engagement in the form of environmental stewardship. The curriculum that I created provides an interactive way for students to explore the relationships among plants, people, and pollinators through hands-on activities in their classroom and in a national park. The pollinator program is divided into three parts. The first section is the school pre-site visit, where park rangers and nursery educators meet the students and introduce the key concepts of the program. The second section consists of a native plant nursery field trip located within or near a national park. The third section is the school post-site visit, where park rangers and nursery educators return to the school to help students develop further leadership skills. Students then take the lead in designing a pollinator garden in their school or home community. The pollinator program engages students in fun kinesthetic activities that help students visualize concepts through real life scenarios in natural settings. It will strengthen communities by helping youth form close connections to nature. The pollinator program will also give youth the opportunity to develop leadership skills that will benefit them throughout their lives. (298 words)

CHAPTER ONE

Introduction

Chapter overview

"Who do the national parks belong to?" I ask enthusiastically to a group of 4th-grade students who are visiting the Golden Gate National Parks for the first time. The students respond with a great number of clever answers, but many of them fail to recognize that the national park belongs to them as well. We then talk about who lives in the national park and who helps take care of it. The students are quick to realize that many animals, birds, insects, and plants live in the park, and that the park also belongs to them, but once again the students fail to realize that youth are an integral part of taking care of our national parks. At the end of a three-hour field trip, as the students joyfully thank us for all the fun they had helping us grow plants, and playing games in our Habitat Demonstration garden, I wonder if I made a positive impact in their lives. I ask myself: how can I ensure that students have a memorable experience in the short amount of time that they spend with us? Will they ever come back to visit the rest of the national park? Most importantly, I wonder if the students truly feel that they have ownership of the national park, and if they feel inspired to take care of the natural areas in their home communities.

In this chapter I describe the path that motivated me to become an environmental educator. I elaborate on my current position, and on the inspiration that youth have given me to develop the ideas for my capstone project. In addition, I illustrate the significance

of researching how national parks, native plant nurseries, and school districts could work together to inspire inner city youth into becoming active stewards of the natural world. At the end of the chapter, I have a summary of its contents as well as a preview of Chapter Two.

Personal and professional path

Many memories have helped shape my deep connection to nature, but the one that I cherish the most took place in a concrete jungle: the heart of Mexico City. I remember a misty morning; sweet aromas come from the kitchen, and comfort my heart. I can still hear my mom's voice: "*Ely, por favor trae una ramita de Yerba Buena del jardín*." I am only seven years old, yet I have been entrusted with a very important mission. I rush to the garden and gather the medicinal herbs we use to prepare a tea for my oldest brother, who was suffering from a terrible cough.

As a young Mexican girl, I was tasked to do chores that my brothers were not required to do. I always felt singled out, but my mother empowered me through nature. She taught me that as a woman I had many important things to contribute to our society. She connected me to plants in such a way that nature became an integral part of who I am. She built raised beds in our small side yard where we grew many medicinal plants. We spent hours tending the garden, and used the herbs for many remedies as well as cooking. Spending time with my mother in the garden as we cared for our medicinal plants gave me a sense of place, a strong connection to nature, and a clear understanding that I was an important part of my family unit.

I strongly believe that my deep connection to nature guided me through college

and gave me a clear vision for pursuing a career in science. As I moved forward in my studies, I felt an enormous urge to share everything I was learning in botany classes. I decided to expand my volunteer work at the University of California Davis Botanical Conservatory to include interpretative tours. It stirred my heart to see children's excitement as they learned about plant adaptations and their diverse ethno botanical uses. Upon graduating from college, I decided to follow my passion to guide others in their own discoveries of the natural world. My career aspirations had shifted from botany research to environmental education.

Current position

I currently work for the Golden Gate National Parks Conservancy, a non-profit organization that partners with the Golden Gate National Parks in California. I am the Education Manager of our four Native Plant Nurseries. We run a community-based operation where people of various ages and backgrounds help grow California native plants used in habitat restoration projects throughout our park lands. The unique setting of our native plant nurseries allows us to offer place-based education programs that emphasize student-centered strategies, including guided inquiry and service learning programs.

The wild and protected areas surrounding San Francisco’s Golden Gate Bridge, stand at the heart of the Golden Gate National Parks. It presents a unique juxtaposition of highly biodiverse habitats where coyotes, hawks, owls, and a myriad of endemic California plants exist right next to urban areas. One would expect every youth in San Francisco to be familiar with the Golden Gate National Parks, and see it as part of their backyard. The reality is that most inner city youth have never visited the park either

because they are unaware it exists, or because they don't have easy access to it. One of the main goals of our organization is to engage youth from inner city San Francisco neighborhoods, and expose them to the beautiful open spaces at the Golden Gate National Parks.

Inspiration from youth

The different interests and origins of the youth with whom I work have consistently presented me with new and unique ways to view the world. They have shaped the educator that I have become, and have inspired me to go further in my professional career. Observing youth's reactions as they help us plant in the Habitat Demonstration Garden gave me the idea of expanding our restoration efforts to help them plant gardens in their home communities. I have also observed many young students become completely mesmerized by bees, butterflies, and hummingbirds as they watch them pollinate flowers in the garden. This gave me the idea of developing a program that could honor their insatiable curiosity for this subject. A natural stage could help students connect with something in nature that they thought was cool, and help them experience first-hand the concepts they learn in their textbooks.

Research question

The focus of this capstone project is a curriculum that allows students to make closer connections with the natural world. I focused on the following research question: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? The goal of the curriculum will be to inspire and guide inner city students to develop green spaces that

benefit our environment and their communities, as well as help others enjoy and value national park lands.

Chapter One summary

Many childhood experiences allowed me to form a strong connection to nature, and motivated me to pursue a career in science. Working as an outdoor educator for several years, has given me the unique opportunity to meet exceptional youth who have inspired me to develop my capstone project. My research question is: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world?

Introduction to Chapter Two

In Chapter Two I investigated strategies that can help organizations across the world engage youth in genuine experiences that inspire them to become leaders and stewards of our natural world. I first researched the importance of engaging youth in environmental stewardship programs. I then looked at student-centered pedagogy to connect natural science standards with best teaching practices. In addition, I researched different strategies related to youth development and community engagement with the end goal of providing students with the necessary tools to develop a culminating stewardship project in their own communities.

CHAPTER TWO

Literature Review

Chapter overview

Connecting inner city youth to nature can be a powerful and life-changing experience. National parks offer unique settings to connect youth to natural places and guide them through a life-long appreciation and care of the environment. In an effort to improve inner city children's personal connections to nature, I investigated the following question: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? The scope of this project concentrated on 4th-grade students. The subtopics addressed in this chapter include the importance of engaging youth in environmental stewardship programs, student-centered pedagogy, youth development, community engagement, and 4th-grade relevant program content in the natural sciences.

Through the research and literature summarized in this chapter, I highlight the importance of my research question and the significance of developing curricula that engages youth in outdoor experiences that help them form a deep connection with our natural world. Environmental stewardship programs are a fun and interactive way to introduce students to meaningful experiences in natural surroundings. Such programs should be designed with a framework that is student-centered as well as culturally relevant to students' diverse learning styles and backgrounds. National parks and native plant nurseries offer a remarkable opportunity to help teachers connect their students to

required science program content, and help students deepen their knowledge of the different concepts learned in the classroom by experiencing these concepts in natural settings. In my view, youth development is one of the most important investments that we can make on behalf of the present and future of our world. If given the necessary tools, youth have the potential to become leaders that create positive changes in their neighborhoods. Youth leaders can also help build strong communities of active citizens that care for the wellbeing of our Mother Earth.

The Importance of Engaging Youth in Environmental Stewardship

The United States Environmental Protection Agency [EPA] defines environmental stewardship as: "The responsibility for environmental quality shared by all those whose actions affect the environment. This sense of responsibility is a value that can be reflected through the choices of individuals, companies, communities, and government organizations, and shaped by unique environmental, social, and economic interests" (2005, p.2). It is clear to me that environmental stewardship is a responsibility that falls on every single person that lives in this world. We all depend on the different resources that the Earth provides us. Unfortunately, many people are disconnected to the consequences of their actions. The boom of technology is creating a new generation of children that are growing with less play time in the natural world and thus, grow disconnected from nature. Through my years of teaching inner city youth, I have encountered many children that tell me they will rather spend their free time playing video games at home than playing in their neighborhood park. How can we change their mindset? Hower, Mac Glash, and Wader Lase, point out that "Building a love of nature and an interest in working to conserve natural resources all starts with having fun

outdoors" (2012, p. 9). If children can make positive connections in natural settings by engaging in activities that excite them, that spark their curiosity, and that nurture their need to explore nature on their own terms, they will be more likely to spend their free time playing in outdoor settings.

It is also essential for youth to become aware of the unique contributions that they can make on behalf of the environment. Teachers, environmental educators, parents, and caretakers can empower youth to become environmental stewards by exposing them to environmental literacy principles that guide them to a better understanding of environmental action. Roth proposes the following constructive learning stages that youth must experience in order to become active stewards: environmental awareness, environmental concern, environmental understanding, and environmental action (as cited by 2011, Blanchard and Buchanan, p. 233). In addition, Kohl suggests that youth need to engage in thoughtful reflections about environmental challenges through concrete experiences, reflective observations, abstract hypotheses, and active testing of their own hypotheses (as cited by 2011, Blanchard and Buchanan, p. 233). In other words, before youth can become environmental stewards, they need to have a deep appreciation for the environment, and a clear understanding of environmental issues. Additionally, youth must also participate in positive environmental stewardship experiences that first reinforce in them their love and appreciation for nature, and second, inspire them to continue engaging in actions that help the environment.

Copple and Bredekamp (2009) point out another important variable to consider when introducing children to environmental stewardship: "The social and cultural contexts in which children live [can] ensure that learning experiences are meaningful,

relevant, and respectful for the participating children and their families" (p. 10). In order for stewardship activities to be meaningful, they need to be relatable and respectful within the framework of the students' own cultural beliefs. National parks and native plant nurseries can work together with school districts to provide a platform where environmental literacy principles learned in the classroom can become alive in parklands through reflective curricula that encompasses the principles proposed by Roth and Kohl. Many national parks have a rich cultural history that can also provide meaningful connections to students' cultural history, reinforcing in them a love for their heritage and natural resources.

Student-Centered Pedagogy

According to Jones, student-centered instruction is characterized by teachers who address the needs and unique learning styles of each student; a type of instruction where the students are encouraged to be active participants in the learning process (2007, p. 2). Over the years, there have been many different models of teaching developed to address the challenge of teaching groups of students with varied learning styles and needs. This section will focus on four models that have greatly influenced the way student-centered pedagogy continues to advance: the Hilda Taba Model, Understanding by Design, Differentiated Instruction, and Place-based education. These models have inspired not only young minds, but also scholars in the education field. The foundation of these models is to approach instruction through experiential teaching techniques that successfully connect students to subjects that are relevant to their lives and are presented in a way that recognize students' diverse and unique learning styles. Understanding by Design and Differentiated Instruction are referred as integrated models.

The Hilda Taba Model

In the early 1960's, Hilda Taba and her colleagues proposed an innovative idea to develop a curriculum that challenged the commonly accepted method, which was a teacher-centered approach. Taba suggested developing learning units that provide the basis for curriculum design where students and teachers actively engage and contribute to the curriculum. This would replace a general plan that prescribe goals and objectives be obtained in a linear manner where students had no input (Lunenburg, 2011, p.2).

Taba envisioned a curriculum that emerged from instructional strategies that emphasized student needs. She also recognized that students are unique and come from different socio-economic backgrounds, have different cultural values, and experience different challenges in their everyday lives. Her model includes five elements, which are all interconnected: objectives, content, learning experiences, teaching strategies, and evaluative measures (Lunenburg, 2011, p.2). This model presents a high level of thoughtfulness by ensuring that the different learning experiences will help students develop skills, knowledge, and attitudes that go beyond the classroom, therefore making it relevant to their understanding of the world.

Gallagher summarizes Taba's teaching strategies into four main areas: concept development, interpretation of data, application of generalization, and resolution of conflict (2012, p.5). Taba approached concept development by providing strong foundations to support inductive thinking, which in turn builds skills that help students form generalizations about the world. Gallagher describes Taba's methodology as similar to constructing a home; builders first pour a foundation (quality information), then build a frame (thinking skills) around it that can support the walls (facts), and finally build a roof

(highest level ideas) on top (2012, p.4). Students actively engage in every step, and build upon their own knowledge as they exercise their acquired skills.

Integrated Differentiated Instruction and Understanding by Design

During the mid 1990's Carol Tomlinson shaped teaching strategies that pay close attention to the needs of a diverse population of students into a model called Integrated Differentiation. Around the same time, Jay McTighe and Grant Wiggins developed the Understanding by Design model, which offers a planning process that strives to achieve effective teaching and assessment of students' understanding and learning that goes beyond the classroom. In 2006, Tomlinson and McTighe combined their philosophies into an outstanding framework of teaching that encompasses the core of both methods. According to Tomlinson and McTighe, the logic of combining UbD and DI is that "The two models stem from current best understandings of teaching and learning" (2006, p.2). The union of the models advances the methodology from a curriculum design to an instructional design.

The integrated model follows four elements that are the foundation for effective teaching: the first one is related to the students (who we teach), the second deals with the learning environment (where we teach), the third one highlights the content (what we teach), and the last element emphasizes instruction (how we teach) (Tomlinson & McTighe, 2006, p.28). The integrated model also honors the idea proposed by Grant Wiggins and Jay McTighe that "Learning results should be considered in terms of understanding the 'big ideas' and core processes within the content standards, and the ideas are framed around provocative 'essential questions' to focus teaching and learning" (as cited by Tomlinson & McTighe, 2006, p. 26). This is similar to the principles of

Taba's model. Students learn through connecting various experiences and knowledge into overarching themes. In addition, the themes focus around subtopics that help guide students' learning.

The authors also propose that "curriculum should focus on the knowledge, understanding and skill that enables students to develop solid frameworks of meaning in a topic or discipline" (Tomlinson & McTighe, 2006, p.40). It is not only important to have a clear goal to keep everyone on task, but the goal should also be meaningful and relevant to the students' lives. Tomlinson and McTighe also point out that the goal should be able to effectively engage students in thinking in a broader perspective, meaning that they will gain an enduring understanding and build upon it as they interact with the world (2006, p.41). This framework provides teachers and educators with tools that help them focus their instruction around a central goal, and approach it from different angles and perspectives through diverse methods of differentiated instruction. The framework establishes clarity about curricular essentials, and thus greatly benefits all students.

Place-based Education

Another important concept in student-centered pedagogy is place-based education where students make deeper connections through experiencing the subjects in real life scenarios. Place-based education focuses on the environment and the local community as the melding point where curriculum learning, strengthening community bonds, appreciation for the natural world, and a commitment to citizen engagement all come together. Sobel defines place-based education as a grassroots movement that uses:

> …the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science, and other subjects across the

> curriculum. Emphasizing hands-on, real world learning experiences, this approach to education increases academic achievement, helps students develop stronger ties to their community, enhances students' appreciation for the natural world, and creates a heightened commitment to serving as active, contributing citizens (2004, p. 7).

Place-based education teaches about both natural and built environments through the history of a place, the culture of its people, their different social issues, as well as the natural aspects of the community. "One of the core objectives is to look at how landscape, community infrastructure, watershed, and cultural traditions all interact and shape each other" (Sobel, 2004, p.9). An important principle of this method is that students are crucial resources to the community. They can make differences in their community by working on real-world projects to benefit their local environments.

The classroom should also be a healthy partnership between students and teachers, where a central goal guides their path. Clear communication and appropriate instruction can build a safe and interactive pathway where students feel invested in their own learning and seek out help when needed, but also lend a hand to peers that can benefit from it. Furthermore, students should be able to set goals that speak to their unique abilities, and at the same time students should be able to foster continual growth in themselves and their peers.

Youth Development

It is a sad reality, but the truth is that many young people, especially in urban environments, face many challenges that inhibit them from developing strong and vital

relationships with people around them and with the natural environment. Li, Nussbaum, and Richards point out: “Risk factors such as poverty, exposure to gangs, drugs, and community and family violence threaten healthy development (as cited by Norton & Watt, 2014, p. 335). When youth face such risk factors, their priorities shift to a survival mode in an oppressing environment. It is vital to help youth in such situations to see the assets that exist in the people and places that surround them, and empower them to create positive changes within their home communities.

Youth Developmental Assets

Research performed by the Search Institute on positive youth development identified a framework of specific elements of healthy youth development known as developmental assets; the assets are divided into external and internal developmental assets (Scales and Leffert, 2004, p. 11). External developmental assets encompass the youth’s support system, understanding of their responsibilities, and a sense of constructive use of their time, whereas internal developmental assets comprise the youth’s personal commitments, values, social competencies, and positive identity (Scales and Leffert, 2004, p.18). Developmental assets also play a crucial role in the way youth view themselves and the role they play in society. If youth lack positive interactions that help them form a confident image of themselves, they will be more likely to engage in activities that are not constructive to their lives.

According to Scales, Benson, and Mannes (2006), “Caring adults outside of young people’s own families play significant roles in providing a number of the developmental assets and, therefore, in the promotion of adolescent well-being” (p. 402). If children feel validated, their self-identity will be enriched in a positive way, and they

will be more open to making closer connections with adults that listen to understand. Kress (2004) identified four essential elements that need to be present in youth development programs to equip youth with the necessary tools to become leaders in their own community: "(1) to feel a sense of belonging; (2) to develop mastery; (3) to develop independence; and (4) to practice generosity" (As cited by Arnold, Dolenc, Wells, 2008, p. 58). Inclusion of these elements in youth development programs sets the stage for youth to develop into community leaders.

Community Engagement through Service Learning

Service learning programs that have a thoughtful approach of engaging youth in nature through student-centered principles, honor children's developmental assets, and provide a platform to allow for meaningful input from the community. They can become excellent venues to help youth exercise their leadership skills. "The integration of learning with public service and outreach is at the heart of service learning, a pedagogy which has students identify problems or needs in their communities, use critical thinking skills to propose solutions and take actions to effect change" (Haque, 2001, p. 127). Haque further illustrates that service learning projects can greatly foster individual learning and provide a stage through which schools and partner organizations can work toward enhancing outdoor learning environments (2001, p. 127).

Community Engagement through Ecological Schoolyards

Inner city youth can directly apply leadership skills gained during Service Learning programs to create positive changes in their schoolyards. Environmental stewardship activities that are compelling to the students' lives can provide the perfect

inspiration for them to re-envision their own schoolyards and transform them from asphalt into ecosystems where they can continue to make connections with the natural world. "When ecological schoolyards are incorporated into the school's curriculum, allowing children to make the connection between themselves and local natural systems, students learn that they can have a positive impact on their environment and have opportunities to heal it" (Danks, 2012, p.5).

Danks illustrates an example of great community engagement in San Francisco's Ulloa Elementary School. The school created a small native plant habitat demonstration garden showcasing coastal dune plant communities found along nearby shores of the Pacific Ocean. The garden was built on a previously underutilized area between the school building and the sidewalk. Danks notes that in addition to student involvement, the garden was "developed through the hard work of dedicated teachers and the volunteer assistance of a member of the California Native Plant Society" (2012, p.36).

Relevant Natural Science Program Content for 4th-grade

Many organizations and schools have developed projects that involve students in meaningful activities in nature. The Bee Hunt! project is one example. It was designed for K – 12 students to increase their awareness and understanding of the importance of bees as pollinators. "The Bee Hunt! provides a safe and unique way for students to explore science and helps students educate others to revitalize pollinator populations and take other actions (Mueller and Pickering, 2010, p. 151). Citizen science projects are also a wonderful venue to engage students in learning school standards in meaningful ways that allow them to make a deeper connection with the curriculum as well as empower them to contribute to a scientific study.

Another example is the Oregon State University Citizen Science Hummingbird Project (OCSHP), which engages students in projects that allow them to understand the populations and habitat preferences of rufous hummingbirds and other common hummingbird species in Oregon: “The goal of the OCSHP is to have students build a data set to help determine whether changes in forest cover and human development lead to hummingbird decline” (Givot, O’Connell, Hadley, & Betts, 2015, p. 26). Through participation of projects such as this one, students learn the importance of pollinators for the sustainability of an ecosystem. Hummingbirds are great pollinators of wildflowers, shrubs and trees. Their long bills and tube-like tongues help them collect nectar from brightly colored tube-like flowers. Although hummingbirds are after the nectar, they pollinate the plant by transferring pollen from a previous flower of the same species. The nectar gives hummingbirds the energy they need to sustain their high metabolism. Pollinators are directly linked to many of the foods that sustain us as a society, so students can fully understand their importance and relate to the material in a personal level.

The Next Generation Science Standards that aligns with similar studies as the ones described above are: 4LS1.A: Structure and Function: “Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction,” and 4LS1.D: Information Processing: “Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal’s brain” (NGSS Lead States 4th-grade, 2013, p.4). The main subject highlighted in these academic standards is how different structures among plants and pollinators serve the pollination process.

Chapter Two summary

This section has presented a literature review of the subtopics that are integral to answering the research question: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? The analysis of the literature provided clear evidence that engaging inner city youth in meaningful experiences in nature can be a life-changing experience. In addition, the literature review also provided insight into student-centered pedagogy, positive youth development, and community engagement principles that can be used to guide national park rangers, native plant nursery educators, and school district officials in thoughtful curriculum development. The review of relevant natural science content highlighted the potential of using the subject of pollination as a meeting point to connect all the subtopics into the development of student-centered curriculum that provides the answer to the research question.

Introduction to Chapter Three

Chapter Three describes the methodology that I used to design an engaging student-centered curriculum that has its core foundations in positive youth development and community engagement principles. The curriculum uses environmental restoration and content standards to focus the students' experience and understanding of the material. The curriculum proposes a partnership among national park rangers, native plant nursery educators, and school district officials that value the input from students and members of their school communities.

CHAPTER THREE

Methodology

Chapter overview

I ask students, “What does ‘stewardship’ mean to you?” And, after a few giggles, and coaching with the pronunciation, some students share very creative guesses of the word’s meaning, but none of them will be completely sure of their answer. Then I ask them: “What do you like to take care of?” They quickly respond with answers such as “my family, my pets, my friends, my video games, my school, my favorite shoes.” Then some of them start understanding that stewardship means to take care of things we value.

This following chapter illustrates the rationale that provides a basis for answering the research question: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? The following segment introduces the outline of the methodology that I used to design a student-centered curriculum that engages children in meaningful stewardship experiences in our natural world. The next part analyzes the setting and age of the participants, and is followed by an overview of the pollinator curriculum. At the end of the section, the Human Subjects review process is addressed. The chapter concludes with a summary and an introduction to Chapter Four.

Connecting a student-centered pollinator curriculum to youth development, community engagement, and environmental stewardship

How can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? One answer is by working in partnership to offer a program based on a student-centered pollinator curriculum that connects to youth development, community engagement, and environmental stewardship. So how would that partnership look? How would these three agencies decide which communities to select for collaboration, and how would they approach such communities? First, each agency can bring to the table what they can provide in terms of service. The outreach strategy should find communities that have a strong need for those services, and school districts can identify specific schools. The three agencies can work together to ensure that the curriculum development of the program follows student-centered principles, as well as appropriate youth development strategies. National parks can provide role models and safe spaces for environmental stewardship programs. Native plant nurseries can provide infrastructure in the form of mentors, plants, tools, and experiential learning activities that allow youth to interact with nature in a way that is fun and contributes to their personal growth. Youth can acquire leadership skills while participating in the pollinator program. They can also apply this knowledge to improve their communities.

Why is the subject of pollination well suited to a program like this? For one thing, the pollination topic has strong potential to engage students in environmental stewardship projects in their local national parks. Furthermore, native plant nurseries provide an excellent venue to learn about the importance of biodiversity and local flora needed for

pollinators, in addition to providing plants for habitat restoration projects. “Schools can help nurture and support local pollinators by providing the right habitat for them” (Danks, 2012, p.28). If youth work together to transform their schoolyards into pollinator habitats, they can both recognize their own potential and use it for positive changes in their home communities. In order to help students relate the material to their personal lives, it is also important to emphasize the interconnections that exist among pollinators, plants, and people. “Pollinators are essential to about three-quarters of more than 240,000 species of the world’s flowering plants and enable the cultivation of more than 90 different agricultural crops” (Mueller and Pickering, 2010, p. 152). Additionally, the content standards can become an integral part of the students’ lives and not just something they have to memorize to do well in a test.

Curricular Framework

As mentioned before, the literature review presented clear evidence that children need to engage in experiential learning activities that successfully connect them to subjects that are relevant to their lives, and are presented in ways that honor their unique learning styles. The pollinator curriculum development is grounded on the following student-centered pedagogical models: Hilda Taba’s model, Integrated Differentiated Instruction and Understanding by Design, as well as Placed-based Education. Theories on the importance of involving youth in stewardship, positive youth development, and community engagement are an essential part of the pollinator curriculum. Important elements for each model will be detailed in the section on the curriculum development process.

Curriculum Development Process

Partnership

An important part of the pollinator curriculum development is the formation of a partnership among national parks, native plant nurseries, and school districts. The partnership serves to integrate different aspects of the curriculum framework such as stewardship, positive youth development, and community engagement. An amazing way to strengthen such a partnership is to connect the environmental stewardship programs to relevant content standards so that teachers can view a trip to their local national park as having more value than just a fun field trip for students to run around. What is even more important, is to connect content standards to experiential learning settings that students can relate to and can also inspire them to be active participants in their own learning. With this in mind, such partnership can truly work to inspire inner city youth to become active stewards of our natural world.

Curricular Tools

The curriculum development is based on the following elements: helping students to create enduring understandings, essential questions that focus the learning plan, and evaluative measures. Each experiential learning activity incorporates tools that acknowledge the following: prior knowledge assessment, checking for understanding, process time, and self-evaluative measures. Every activity will be connected to the program goals, and will build onto the next so students can advance their knowledge of the program's core ideas. The teaching materials will incorporate kinesthetic, auditory, tactile, and visual activities. A performance task assessment tool will be incorporated to measure student understanding of the material [See Appendix section A & B].

Setting

The intended setting of the education program includes national park habitat restoration sites and community school garden sites. Native plant nurseries that work in conjunction with national parks will also provide a setting for students to learn the process of growing and caring for plants to put in pollinator habitat gardens. The literature analysis revealed that today's youth are spending less time playing outdoors, and more time focusing on sedentary activities indoors. The National Academy of Sciences reports that visits to national parks declined 23 percent from 1987 to 2006 (as cited by Hower, MacGlash, & Wader Lase, 2012, p. 6). The different outdoor settings for the education program will allow youth to discover new forms of play that will spark their curiosity and help them develop a love and respect for nature.

Participants

The pollinator curriculum is designed for 4th-grade students from low income communities of inner city neighborhoods that have very little access to natural areas. The program can be adapted for any ages, but I chose to concentrate on youth that are in 4th-grade. I believe that students in this grade are at an optimal age to let their curiosity and excitement guide them in new discoveries. This will help them be open to new ideas, and feel more comfortable in new surroundings.

Roffman, Pagano, and Hirsch point out that a positive youth development framework is vital for youth of low income families that live in urban environments, where they are exposed to many external risk factors such as drugs, violence, and gangs (as cited by Norton & Watt, 2014, p. 337). Exposing urban youth to natural areas can

help them see a different reality that can become an integral part of their lives. “By tackling problems and serving real needs within the community, students begin to see that their own decisions and actions can help to improve the quality of life for all” (Haque, 2001, p. 127). It is also important for youth to appreciate their own communities and find positive resources among the people and areas that surround them. Service Learning programs that thoughtfully engage youth in nature, honor their developmental assets, and provide for meaningful input from the community, can become excellent venues to help youth exercise their leadership skills.

Pollinator curriculum overview

The pollinator curriculum is composed of three parts. The first part consists of a school visit by park rangers and nursery educators to introduce students to the key concepts of the program, and to gather students’ ideas and suggestions. The second part of the program is a field trip to a native plant nursery located within or near a national park. The third part is a series of school visits delivered by park rangers and nursery educators to help students develop further leadership skills. Students then lead the design, planning, and planting of a pollinator garden in their school or home community.

The curriculum addresses 4th-grade California Common Core State Standards focused on engaging students in group discussions as well as writing narratives. Students will write reflections of their experiences on the student journal. Students will also have the opportunity to write poems and stories about their new understandings. The curriculum also emphasizes 4th-grade Next Generation Science Standards that focus on plant and animal adaptations, structures, functions, and interconnections among living and non-living things.

Human Subjects Review Process

The scope of this project was focused on curriculum development. The project did not encompass student observations nor student assessment. There were no adult questionnaires either. The curriculum design is based on student-centered pedagogical frameworks mentioned earlier. A short form to the Human Subjects Review was submitted where a detailed explanation of the curriculum process was provided. The absence of student and adult data collection was also addressed on the form.

Chapter Summary

Informed by the literature review, this chapter presented a framework for answering the research question: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? This chapter emphasized four important elements that provide the foundation to answer the research question: student-centered pedagogy, relevant science content to fit school standards, positive youth development, and community engagement in the form of environmental stewardship. In addition, the chapter addressed the methodology and rationale I followed to develop a thoughtful student-centered pollinator curriculum that engages inner city students in experiential learning activities, environmental stewardship, positive youth development, and community involvement in school gardens. The goal of the curriculum is to allow children from low income communities that have very little access to outdoor spaces make meaningful connections to their natural surroundings, and to develop a sense of responsibility to care for natural areas.

Introduction to Chapter Four

Chapter Four describes in depth the curriculum materials that I developed to answer the research question previously mentioned. I also developed a comprehensive guide of the different activities that are to be facilitated by national park rangers, nursery educators, and teachers during the school visits and the nursery field trip. I also address in detail differentiated instruction tools and specific experiential learning lessons. Finally, I created a student booklet to be used as a guide for throughout the program. The booklet encourages students to exercise their different learning styles, and includes performance tasks to measure their understanding.

CHAPTER FOUR

Results

Chapter overview

I have been investigating the research question: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? Through the literature review and analysis, I found the following answer: by working in partnership to offer a program based on a student-centered pollinator curriculum that connects to youth development, community engagement, and environmental stewardship. The answer to the research question is founded on four elements: student-centered pedagogy, relevant science content, positive youth development, and community engagement in the form of environmental stewardship. I will analyze these four elements with examples from the pollinator curriculum throughout this chapter.

Why do plants, people, and pollinators need each other? This essential question frames the student-centered pollinator curriculum that I developed in partnership with Golden Gate National Park rangers and San Francisco Unified District teachers. The program provides a tangible model for students to explore the relationships among plants, people, and pollinators through fun learning experiences in the classroom and in a national park.

The pollinator program is divided into three parts, so I will organize this chapter according to the natural progression of the program. The first section is the school pre-

site visit, where park rangers and nursery educators meet the students and introduce the key concepts of the program. They also gather ideas and suggestions from the students. The teachers follow up with further pre-site activities that will help students prepare for the rest of the program. The second section consists of a native plant nursery field trip located within or near a national park. The third section is the school post-site visits, where park rangers and nursery educators return to the school to help students develop further leadership skills. Students then take the lead in designing a pollinator garden in their school or home community. The chapter ends with a summary and an introduction to Chapter Five.

School Pre-Site Visit

Outline

During the school pre-site visit, park educators introduce the goals for this section, the student expectations, and the student assessment measures [See Appendix A & B]. The students give feedback regarding their expectations, and suggest further assessment methods. Then, park educators engage students in a conversation about neighborhood and national parks. They present a California poppy dress-up skit, and a pollination video. The next day, the teacher follows up with a hands-on vocabulary activity, a pollination drawing, a plant-pollinator matching game, and a discussion of the essential questions of the program. Students write down their observations in their journals as they prepare for their field trip to the native plant nursery.

Program Goals

The goals include setting student expectations, introducing the assessment measures, discussing parks, and familiarizing students with the pollination process.

Student Journal Overview

I developed the student journal in partnership with national park rangers, and with the guidance of San Francisco Unified School District curriculum experts. The journal is intended to be an interactive tool, where students can express themselves, record their observations, and evaluate their own work [See Appendix section C]. It will also allow teachers and park educators to assess student readiness, and make appropriate changes to the curriculum when needed.

The illustrations of the journal were inspired by common pollinators and California native plants that students will see at the nursery and likely in their school garden. I incorporated pictures of youth that have attended various education programs at the Golden Gate National Park nurseries with the goal that students will see themselves reflected in the pictures and feel more connected to the program. This student journal can serve as a template for those who wish to incorporate the curriculum at their own sites. Pages of the journal will be placed with their corresponding activities below.

Park Staff Facilitated Classroom Lesson

The activities introduced by the park educators are mostly prior knowledge activities, which will help assess student readiness on the subject. Park educators will introduce the programs goals for this section, the student expectations, the teacher assessment measures, and the student self-assessment worksheet [See Appendix A & B]. Park educators and teachers will gather student feedback through the different activities, and will make any needed changes to the program. The activities for this section include a conversation about neighborhood and national parks, a California poppy costume dress up skit, and a pollination video.

Neighborhood and national parks. Students engage in a conversation about their local parks and the different activities they like to do when they visit those parks. Then students also talk about which national parks they have visited or heard of. They engage in a deeper conversation about who the parks belong to. In addition to sharing with their classmates, students write down their thoughts and new ideas in their journal as shown by Figure 1.

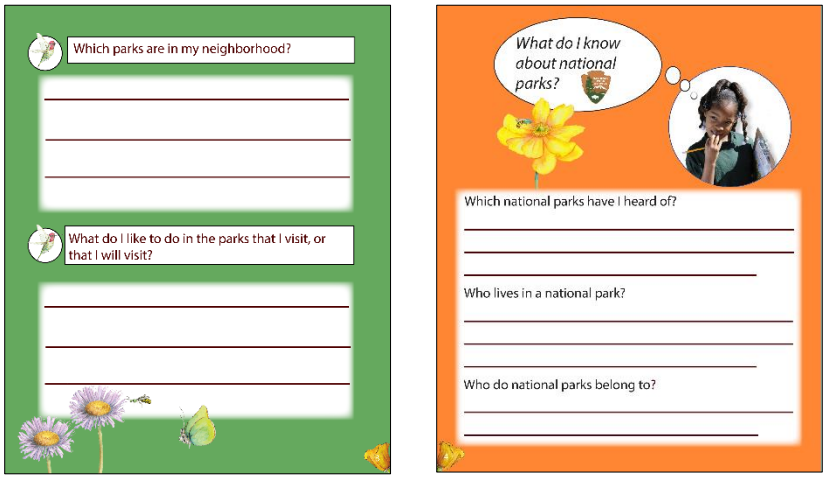

Figure 1. Prior knowledge of neighborhood parks and national parks. This figure illustrates pages 3 and 4 of the journal, which give students the opportunity to talk about their neighborhood parks and national parks.

This activity is an example of student-centered pedagogy and positive youth development. The students' experiences and perspectives drive the conversation. Their neighborhoods and experiences are viewed as assets to the program. The students engage in a deeper conversation about a sense of ownership and belonging to national parks. At the end of the activity, the students gain a better sense of the national park they will visit. The journal serves as a guide for the conversation, and allows teachers and park educators to evaluate the students' work. The journal also helps students organize their thoughts and review their understanding later in the program.

California poppy costume dress up skit. Students review their knowledge of plant parts and the different elements needed for their survival as they dress up a classmate in a California poppy costume. While students are sitting in a circle, a student volunteers to get dressed up in the costume. When park educators ask the students: "What do plants need to survive?" students share their answers with their neighbors, and raise their hands when they are ready to participate. Park educators give students enough time to think and share. If, for example, a student answers that plants need water to survive, park educators ask the class "How does the plant get water?" Students have to think about the different parts of the plant that help it absorb water. When a student answers "roots," park educators invite two students to find the roots from the costume box and wrap them on the feet of their classmate.

Different students help dress their classmate as they associate sunshine and CO_2 with the leaves, as well as water and nutrients with the trunk and roots. They wrap the light green leaves around their classmate's arms, and a dark green stem that their classmate wears as an apron. In a similar interactive manner, students review the different parts of the flower, and continue dressing their classmate with petals, stamen (filaments and anthers), and pistil (ovule, style, and stigma) until he or she is fully transformed from head to toe into a California poppy.

After a quick review of the plant parts and their functions, park educators ask the students "Why do you think the petals are so colorful, and why does the flower smell so nice?" Students will then engage in a conversation about pollination, and share examples of pollinators. Students will find hummingbird, bees, bumble bees, bats, lady bugs, ants, and other pollinator puppets in the costume box. Park educators will encourage all

students to participate in a pollinator puppet dance to get their energy flowing as illustrated by Figure 2.

Figure 2. California poppy costume dress up skit. This figure illustrates a fun, role-play activity where students review the different structures of the plant, their functions, and how they relate to the process of pollination.

This is a fun kinesthetic activity that honors student-centered pedagogy. It gives students a chance to move around and interact in role play. It also helps students visualize concepts through games, and might help them understand the material better. This is also an example of relevant science content. Even though this activity is mostly intended to assess students' prior knowledge, it also ensures that all students have a common understanding of different plant parts, their functions, and how they relate to the process of pollination. This will help students have a clear understanding of the basics of the subject, and will be ready to make connections when new concepts are introduced.

Pollination video. Students watch a TED talk time-lapse video called *The Hidden Beauty of Pollination* by Louie Schwartzberg. The video shows time-lapse shots of flowers going from closed buds to fully open flowers, and shows the interaction between flowers and pollinators. The video does not have any narration, which gives students a chance to form their own ideas and pay attention to the visuals. The background music is

carefully timed so that it accentuates the actions of the pollinators or the openings of the flowers.

Whenever I am with students in the garden, I always seek out the opportunity to ask them "What is pollination?" Their answers always surprise me. Many students think that pollination is when bees collect honey from the flowers so we can eat it. Students don't realize that the bees and other pollinators are actually after the sweet nectar that the flowers make. Once the bees collect enough nectar, they return to the hive and pass that nectar to other worker bees, who chew it up until it gradually becomes honey. As the bees go from flower to flower, they brush against the anthers, and get pollen grains stuck in their hairy bodies. Without knowing it, the bees then transfer that pollen into the stigma of that flower or to another flower of the same species. When the pollen touches the stigma, which is the sticky part of the pistil, fertilization occurs and the flower eventually transforms into a seed. The ultimate goal of the plant is to reproduce, and it uses the flowers to attract insects, birds, and small mammals to help it achieve that goal through the process of pollination.

This activity is another example of student-centered pedagogy and relevant science content. It provides students with visual examples of the pollination process in action. The video allows us to view details that can't be seen so easily by just looking at a flower. The time-lapse format gives students a unique perspective of how flowers develop, and eventually become fruits after being pollinated. The video also highlights unique flower structures like the nectar guides that lay out a straight path for pollinators to find the nectar. Close-up shots of pollinators such as butterflies and hummingbirds, help students to have a better understanding of the concept of form and function. In the

video, students can see a butterfly using its long proboscis to extract the nectar from the flower, or a hummingbird's long beak that reaches into long tubular flowers.

Teacher-Facilitated Classroom Lessons

The teacher takes the lead in facilitating the rest of the pre-site lessons to prepare students for their field session at the native plant nursery. The pre-site lessons are extremely important in laying down a strong foundation. Every activity that the students engage in is connected to the goals of the program, and builds onto the next activity to help students advance their knowledge of core ideas of the program. The activities for this section include assessment measures, a vocabulary activity, a pollination scientific sketch, essential questions, and a pollinator-plant matching game.

Assessment measures. The teacher guides students in a discussion of their understanding of the program goals and evaluates student needs. Students give further feedback to teachers about their needs and propose changes to the program according to their unique styles of learning. The teacher shares this information with park educators so they can also make appropriate changes to the activities during the native plant nursery field trip session.

The teacher introduces the ABCDEs guidelines, which will be used to evaluate all the required journal sketching. A-accuracy, B-big, C-clear, D-detailed, E-explanatory. Teachers encourage students to pay attention to detail and record their observations, and discourage them from focusing on making a pretty picture. These guidelines will help students pay closer attention to their work, and make better connections to the content of the program.

Assessment measures are an important feature of student-centered pedagogy. The

Hilda Taba Model, Understanding by Design, and Differentiated Instruction all emphasize presenting students with clear expectations at the beginning of every activity; they also stress having relevant assessment measures that are equitable for all students.

Vocabulary Activity. The students learn the meaning of important words that will help them understand the main concepts of the program. First, the teacher writes down the following words on the board: adaptation, camouflage, flowers, habitat, indigenous, national park, plant cycle, plants, pollination, pollinators, stewardship. The definitions to these words can be found on pages 18 and 19 of the student journal. Then students choose a word and write it in the middle of the page, as illustrated by Figure 3.

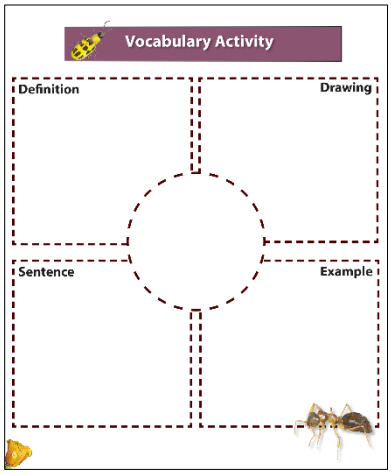

Figure 3. Vocabulary. This figure illustrates page 6 of the journal, which helps students learn the vocabulary of the program.

The vocabulary word is surrounded by four squares. The squares are each assigned in one of the following order: write a definition of the word, draw a picture of the word, write a sentence using the word, and write an example of the word. After filling out one of the boxes of their choosing, students walk around the classroom and ask their classmates to fill out the rest of the squares. This gives the opportunity for students to get ideas from each other, and to work as a team.

The teacher debriefs the activity by going over the vocabulary, using the students' contributions, and making sure that all students have a clear understanding of every vocabulary word. The students can revise their journal work as needed. Once students feel comfortable with all the vocabulary words, they choose a new word to describe, as illustrated in Figure 4. Furthermore, the students are required to connect that vocabulary word with the native plant nursery.

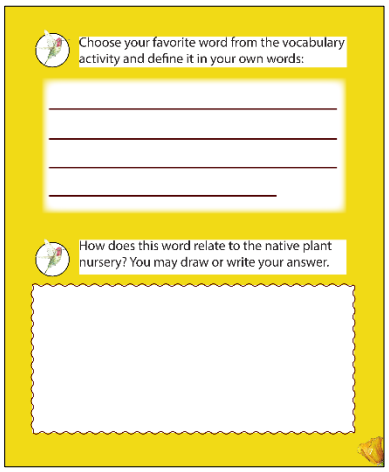

Figure 4. Description of a vocabulary word. This figure illustrates page 7 of the journal, which allows students to exercise their knowledge on a vocabulary word.

This activity is an example of Differentiated Instruction, which honors student-centered pedagogy. Each student has the opportunity to express themselves in a manner that comes more naturally to them. Students are also able to learn a new word in four different ways, which helps them understand that word more deeply. This vocabulary activity is also an example of relevant science content. It will help students have a strong foundation of competency in the Next Generation Science Standards of 4LS1.A: Structure and Function: "Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction," and 4LS1.D: Information Processing: "Different sense receptors are specialized for particular

kinds of information, which may be then processed by the animal's brain" (NGSS Lead States 4th-grade, 2013, p.4).

Pollination scientific sketch. Students demonstrate their understanding of pollination by explaining how each flower part is related to pollination, as shown by Figure 5. Students are encouraged to watch the *Hidden Beauty of Pollination* a second time, and any extra pollination videos in their preferred language.

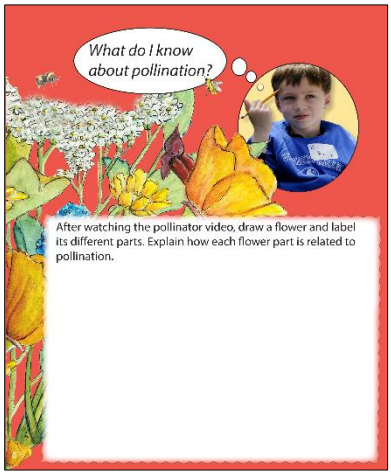

Figure 5. The process of pollination. This figure illustrates page 8 of the journal, where students connect the different parts of a flower to the process of pollination.

This activity offers a further example of student-centered pedagogy and relevant science content. It helps students assess their knowledge of pollination, and challenges them to explain it through the perspective of a flower. By sketching the different flower parts, students become more familiar with the important functions that each flower part provides during the pollination process. This helps exercise their understanding of structure and function related to plants and pollinators. It also helps students clarify any questions they have about pollination, and helps them process the information from a different point of view.

Essential Questions. The essential questions are designed to stimulate students to make a personal connection with the core ideas of the program. As Figure 6 illustrates, the essential questions are *What would happen if pollinators disappeared from our planet? How would the disappearance of pollinators affect your personal life? What can you do to help pollinators?*

Figure 6. Essential questions. This figure illustrates page 9 of the journal, where students connect the essential questions to their personal lives.

This activity is an example of student-centered pedagogy and positive youth development. The essential questions engage students in a thought-provoking process related to something that they will encounter throughout their lives and around the world. Moreover, the essential questions will give them a clear sense of why this subject is worth learning. The knowledge and skills that students learn from the program will greatly help them associate the content to subjects in other disciplines.

Pollinators and California Native Plants Matching Game. This game reinforces the concepts of structure and function. This is another example of student-pedagogy and relevant science content. Students will become familiar with pollinators

and plants that are common in California, so they can continue seeing and learning about them outside of this program. The pollinators are: Anna's hummingbird, California bumble bee, false honey ant, green hairstreak butterfly, metallic green bee, western spotted cucumber beetle, and white-lined sphinx moth. The plants that I chose are: buttercup, California poppy, coast blue blossom, seaside daisy, soap plant, twinberry, and yarrow. The teachers will have access to multiple copies of laminated card sets of pollinators and plants, so students can use them as reference any time they need.

Each plant card is designed with a colorful close-up of the flower on the front, and details of the flower's smell, color, shape, and nectaries on the back [See Appendix section D]. In addition, I included a couple fun facts on the back of the card. In a similar fashion, the pollinator cards contain a colorful picture of a pollinator on the front, and information about the different qualities that the pollinator seeks in a flower on the back. As Figures 7 and 8 illustrate, the information on the back of both types of cards is arranged in boxes to make the information more accessible for students, and to help match the pollinators to the flowers they like.

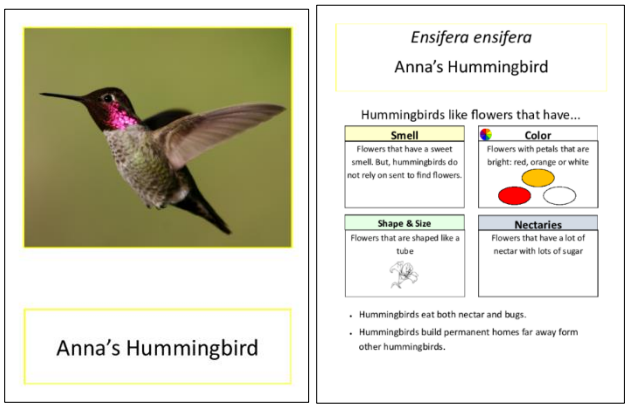

Figure 7. Anna's hummingbird pollinator card. This figure illustrates the Anna's hummingbird, an example of a California native pollinator that students will see at the native plant nursery. The back of the card contains information related to the flower that that this pollinator likes.

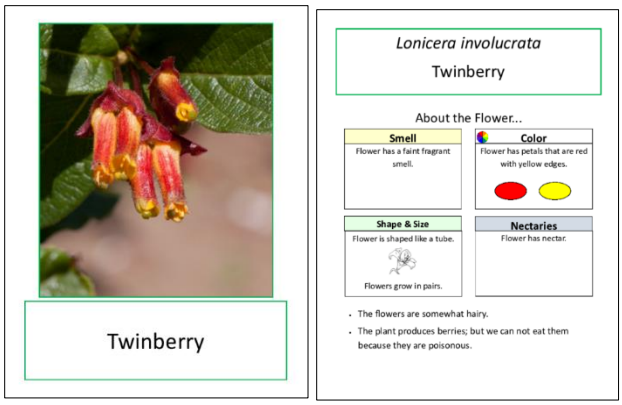

Figure 8. Twinberry plant card. This figure illustrates twinberry, an example of a California native plant that students will see at the native plant nursery. The back of the card contains information related to the flower.

Students break up into small groups, and each group receives a set of laminated cards containing seven pollinators and seven California native plants. Each student chooses a picture of a pollinator that they like, and study the back of the card to learn about the type of flowers that their pollinator likes. They will learn about the structures of the flower that attract the particular pollinator, such as smell, color, shape, and size. Then, with their new information, students match the laminated cards of the pollinator to its flower based on their understanding of structure and function. There are many possible answers. Students need to find the answers based on their rationale of structure and function.

The teacher debriefs the activity by facilitating an open discussion of flower and pollinator relationships. The end goal of this activity is for students to learn generalizations about common California pollinators and the flowers they are attracted to, so they can apply that knowledge to pollinators and flowers from around the world. Figure 9 illustrates the most common answers to the pollinator and flower matching game.

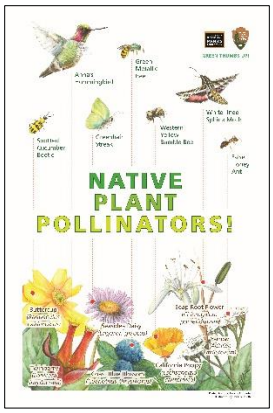

Figure 9. California native plant and pollinators. This figure illustrates California native plants and their common pollinators. This poster is given to all students at the end of the pre-site activities. The poster was designed for this program by George Carpenter and the illustrations by Daniele Jolette.

Students will learn that:

Hummingbirds prefer flowers like twinberries that are shaped in a tube so their long beaks can penetrate the flower. They are attracted to red, orange, and white flowers, and need large amounts of nectar.

Bees and bumble bees love flowers that are in clusters like Coast blue lilac, and flowers that are disc-shaped like the California poppy. They are also guided by the sweet smells of flowers that have high amounts of nectar. They are attracted to flowers that are yellow, orange, and blue.

Ants love sweet smells and prefer small flowers in clusters like yarrow. They visit flowers of many different colors, but prefer those that are closer to the ground.

Butterflies need flowers like seaside daisy that provide them with a landing structure, so they prefer red or purple flowers that are flattened and disc-shaped. They are highly attracted to sweet smells and need plants with large amounts of nectar.

Months need flowers that open at dusk like soap root, and release strong sweet aromas that will provide them with a rich amount of nectar. They like small flowers

shaped in a semi-tube, and prefer colors that allow them to blend in with the petals such as lavender, pink, or white.

Beetles like flowers that are shaped in the form of a bowl like buttercups. They enjoy fruity and spicy smells, but are not after the nectar since they actually eat other parts of the plant. They prefer yellow and other pale colored flowers.

As an assessment activity, students work on the pollinator rubric on their journal as illustrated by Figure 10. Students can infer the answers to the rubric from the back of the pollinator and plant cards.

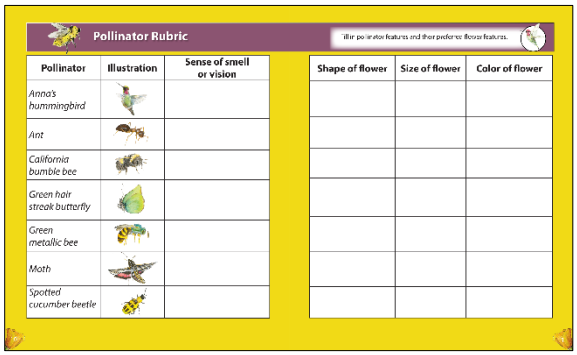

Figure 10. Pollinator rubric. This figure illustrates pages 10 and 11 of the journal, where students demonstrate their understanding of pollinators and the flowers they are attracted to.

At the end of the activity, students reflect on new ideas learned, and ask further questions about the material. They evaluate their own work and fill out a self-assessment rubric [See Appendix B]. Students also have the opportunity to modify their answers in their journals as they acquire new understanding of the main concepts. The teachers evaluate students' progress, and make note of changes needed in order to accommodate all of their needs. Students can also give suggestions of changes to the program activities. The teacher shares any pertinent information with the park educators so they can also make appropriate changes to the activities during the field trip to the native plant nursery.

Native Plant Nursery Field Session

The second part of the program consists of a three-hour nursery field trip facilitated by park rangers and native plant nursery educators. The field trip starts with a welcome to give students a sense of place. It is followed by three rotations, and ends with student reflections. The rotations include a nursery tour, a garden stewardship activity, and a pollinator investigation. Students are divided into three groups to facilitate discussions, and increase participation at each rotation. Students write their observations on their journals.

Program Goals

The pollinator program goals for this section are first, to enrich students' understanding of place through inquiry. Second, to experience national parks as places for learning and recreation, and develop a personal connection with their local national park. Third, to understand the uniqueness of plant habitats via community-based habitat restoration. Fourth, to lead students through a scientific exploration of the pollination process by delving into structure and function principles of plants and animals. The program goals emphasize the interconnections among pollinators, plants, and people, and give students the opportunity to relate the material to their personal lives.

Nursery tour

Students participate in a nursery tour as they review the concepts of the plant life cycle and plant adaptations. They also exercise their knowledge of plant and pollinator structures and functions. The tour is designed to be interactive, and will reinforce what students have been studying during the pre-site activities. The tour will also give students a sense of place of their new surroundings.

During the introduction, students will learn about the unique partnership among their school, the native plant nursery, and the Golden Gate National Parks. Students will be encouraged to see the native plant nursery as an extension of their classroom. They will hear about our nursery volunteer community, and how students like them help us grow and plant more than 60,000 plants every year. Their help will directly support pollinator habitats in the national park.

At the Seed Lab, students will observe different seeds and learn about their dispersal adaptations. They will use microscopes to make close observations of seeds and flower parts. Students will observe, touch, and smell the plants that they have been studying back in their classroom: buttercup, California poppy, coast blue blossom, seaside daisy, soap plant, twinberry, and yarrow. As a closing activity at the Seed Lab, students will investigate the different colors of pollen as they observe the different flowers under the microscope. Students are always amazed to learn that pollen is not only yellow, but actually comes in many different colors such as pink, purple, white, orange, and blue.

Then, students will head out to the Mist House, Greenhouse, and Shade House to see the progression of the plant's life cycle at a native plant nursery. Starting from seeds at the Mist House, plants are grown in flats. The Mist House provides the seeds a warm environment with misty air so they can germinate. Once the seedling has a set of three pairs of leaves, it gets transplanted from a flat into its own pot. The seedling is moved to the Greenhouse, where it will grow sheltered from the elements for a few weeks. The small plant is then moved into the Shade House to reach maturity as it is exposed to wind, rain, and sunshine. In the Shade House, the plants acclimate to the local environment, and

as soon as the rainy season begins, volunteers and students help plant them in restoration sites throughout the national park. At the end of this rotation, students have time to record their observations on their journal as illustrated by Figure 11.

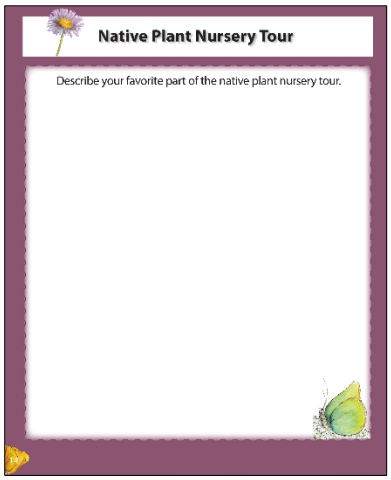

Figure 11. Native plant nursery tour. This figure illustrates page 14 of the journal, where students describe their favorite part of the tour.

The nursery tour is an example of student-centered pedagogy in the form of place-based education, and it is also an example of relevant science content. Students learn in a natural setting where plants and pollinators thrive, and can witness their interactions in the garden. The activities during the tour will also reinforce the concepts of structure and function. The microscope investigation in the Seed Lab, will help students view flower parts from a perspective of form and function. They will make new connections with the subjects they are studying.

Pollinator investigation

During this activity, students will have access to the plant and pollinator cards that they used in their classroom, so they can refresh their memory when needed [See Appendix section D]. Before heading to the garden, each student will choose a pollinator to present in front of their classmates. They will have access to the pollinator puppets that

were used during the pre-site activity. Students will present the pollinator's structures and the specific functions they have. Students will also go over the type of flower that their pollinator is attracted to including its smell, color, shape, and size. The pollinators they will review are: Anna's hummingbird, California bumble bee, false honey ant, green hairstreak butterfly, metallic green bee, western spotted cucumber beetle, and white-lined sphinx moth. All students will contribute to the conversation, and will be able to refer back to their journal notes from the pre-site activities.

Once students head out to the Habitat Demonstration Garden, they will be asked to point out the plants they have been studying in their classroom: buttercup, California poppy, coast blue blossom, seaside daisy, soap plant, twinberry, and yarrow. They will be able to use their senses to make specific observations of the interactions between plants and pollinators. Students will be able to easily spot hummingbirds, bumble bees, ants, and native bees in the garden. Students will have magnifying glasses to help them in their garden exploration.

After their garden observations, students will create a 3-D pollinator-flower model using their imagination. Students will have access to scissors, glue, construction paper, and pipe cleaners of different colors to create their pollinator-flower model. Students must apply the concepts of structure and function in their models. They will need to demonstrate the structures that allow the pollinator to move from flower to flower, to gather nectar from the flower, and to transfer pollen. Students will also create the flower that their particular pollinator is attracted to. Students will present their pollinator-flower model in front of their group. At the end of the activity, students will draw or write a story about their pollinator on their journals as illustrated by Figure 12.

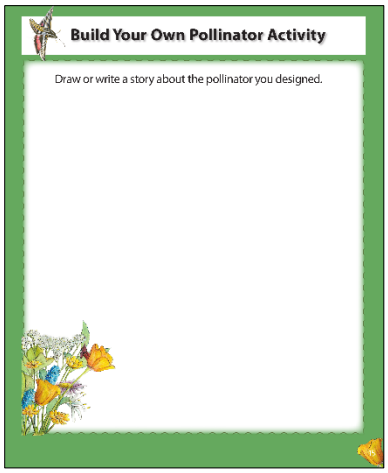

Figure 12. Build your own pollinator. This figure illustrates page 15 of the journal, where students share a story of the pollinator they created.

This activity is a great example of place-based education. It helps students test their knowledge of structure and function by observing what actually happens in nature, as opposed to just reading about it in their books. Students will also review the essential questions of the program: *What would happen if pollinators disappeared from our planet? How would the disappearance of pollinators affect your personal life? What could you do to help pollinators?* Students will reflect on the different ways in which pollinators help our food systems as they observe pollination happening right in front of their eyes.

This activity is also an example of positive youth development. By fostering the use of imagination, students are able to contribute to their learning from their own perspective. The pollinator-flower models from each student will add richness to the program, and their input will be viewed as assets to the program. In addition, students will have the opportunity to exercise their creativity and understanding of the material to narrate a story of their unique pollinator-flower model. The different student stories will add richness to the program.

Service Learning

Park educators lead a conversation about stewardship and ask students "What does stewardship mean to you?" Students share with their neighbors and have time to reflect on their journals, as Figure 13 illustrates. Park educators will introduce the service learning activity, and will emphasize its importance to native plant nursery's growing goals. The activities vary according to the season and needs of the nursery, but may include transplanting, out-planting, pot washing, or seed cleaning. Priority should be given to planting in the garden if weather and nursery needs allow it.

After their service learning activity, students will reflect on their contribution to the native plant nursery, as shown by Figure 13. Students will be able to make additional remarks to the question of "What does stewardship mean to you?" In addition, students will reflect on the kind of service-learning that they just experienced.

Figure 13. Nursery stewardship reflection. This figure illustrates page 16 of the journal, where students reflect on the meaning of stewardship and their contribution to the native plant nursery.

Then, students will relate their stewardship accomplishments to helping pollinators, as Figure 14 demonstrates. Park educators will engage students in a conversation about stewardship in their communities by asking "How can you act as a

good steward to a living thing in your yard, park, street, or playground?" Students will think of a stewardship project to do in their school or communities.

Figure 14. Stewardship connections. This figure illustrates page 17 of the journal, where students connect the stewardship activity to the program goals and their personal lives.

This activity is an example of community engagement via environmental stewardship. Students are active participants in a project that will help the native plant nursery reach its goals. Students will understand that without their help, the nursery would not be able to grow as many plants for habitat restoration projects. Students will be able to see for themselves that their contribution is important to maintain healthy habitats. They will also understand that by helping the native plant nursery they are also helping plants and pollinators.

At the end of the field trip, students reflect on the different activities they engaged in. They make new connections between the program goals and the essential questions, and relate them to their personal lives. Students write any additional observations on their journals, and as a group share highlights of their new experiences. Students do another self-assessment and make notes of new understandings. Park educators and teachers evaluate students, and make any needed changes for the next part of the program.

School post-site visits

During the third part of the program, park rangers and native plant nursery educators return to the school for a series of post-site visits. Teachers and park educators will be in constant communication throughout the program to be well informed of students' readiness, needs, and preferred learning styles. They will also help students improve their leadership skills. Students will work together to design and implement a pollinator garden. Students will also reflect on their challenges and accomplishments. The activities for this section are research and planning, pollinator garden plan presentation, and planting day.

Program goals

The student goals for this section include gaining leadership skills, researching and designing a pollinator garden, and leading a planting day.

Research and planning

Students will divide into smaller teams, and will set clear goals for each team. Park educators and teachers will help the students take on leadership roles according to their goals. Students will use technology to research types of plants needed for a pollinator garden. Native plant nursery staff will provide guidelines for California native plant gardening. Most California native plants such as coast blue blossom, yarrow, seaside daisy, soap plant, twinberry, and California poppy are drought tolerant and require minimum maintenance, which makes them ideal plants for a pollinator garden. Students will be familiar with these plants since they have been studying them during the pre-site activities, and would have seen them at the native plant nursery. Students' understanding of the type of plants that different pollinators like will also help them have a better idea of

what kind of plants they can plant in their pollinator garden. Once students have accomplished their team goals, they will gather back as a class and will work together to incorporate all their information and ideas into their master plan.

As part of the planning process, students will contact appropriate school staff to acquire permits, or to make further connections to help them in their pollinator garden planning. Students will also design a garden maintenance plan to ensure the upkeep of the garden throughout the school year. The native plant nursery will provide tools, soil, wood chips, and plants for the school's pollinator garden. It will be up to the students to decide on the quantity of soil, and the types and quantity of plants.

Pollinator garden plan presentation

Students will outline their plan for developing the pollinator garden on their journals, as shown on Figure 15. Students will work as a larger team, but will have individual responsibilities. Teachers and park educators will assist them if needed.

Figure 15. Community stewardship project. This figure illustrates pages 22 and 23 of the journal, where students write down and draw a plan for their community stewardship project.

Students will present their pollinator garden plan to the park educators and their teacher. Park educators and teachers will guide students to solve any unforeseen challenges. Students will evaluate their own work, and will make appropriate changes to their plans. Students will divide the work in a way that will give everyone the opportunity to lead.

Planting day

Students will lead the planting day with help from park educators and their teacher. Students will assign leadership roles to each other and will lead the planting of the pollinator garden. They will set their goals for the day and review the student expectations. The class will be divided into smaller groups so everyone can have the opportunity to take on a leadership role. The students will need to accomplish the following tasks in preparation for planting: get the tools ready, spread the soil in the planting area, fill up watering cans, fill up buckets with wood chips, group native plants according to their watering needs, lay out the plants on the ground, and dig holes. Once they are ready to start planting, students will need to spread themselves out in the planting area so they don't step over the plants. Students will keep records of the species they planted so they can monitor their garden throughout their school year.

At the end of the activity, students will reflect on the goals accomplished, and will talk about any challenges that need to be addressed. Students will also connect their accomplishments to the essential questions and goals of the program. Park educators and teachers will emphasize the contributions that students have made to the national parks, their school, and their community.

All the activities of the post-site visit are examples of positive youth development and community engagement via environmental stewardship. As discussed in the literature review, youth developmental programs are characterized by providing youth the means to acquire external and internal developmental assets (Scales and Leffert, 2004, p.18). By participating in the post-site visit activities, youth will have a support system composed of mentors from the Golden Gate National Park and native plant nurseries,

who will guide them to achieve a common goal. Students will have a clear understanding of their roles and responsibilities, and will exercise their leadership skills. Through the different activities, students will have a sense of accomplishment and constructive use of their time, which will help them gain a positive image of themselves.

Kress (2004) identified four essential elements that need to be present in youth development programs to equip youth with the necessary tools to become leaders in their own community: "(1) to feel a sense of belonging; (2) to develop mastery; (3) to develop independence; and (4) to practice generosity" (As cited by Arnold, Dolenc, Wells, 2008, p. 58). At the end of the program, students will feel accomplished and will have closer connections to pollinators as they see them visiting the habitat they help create in their pollinator garden. Through this program, the subject of pollination will have a continuing meaning for the students' personal lives. They will have learned the science standards by experiencing nature, and by being active participants in their learning.

Conclusion

In conclusion, this student-centered pollinator curriculum has the potential to reach youth across the nation, especially inner city children that don't frequent natural spaces. National park rangers, native plant nurseries, and teachers can work together to implement the program in their area. Working in partnership can help strengthen community relationships. In addition, this program has the potential strengthen communities by helping youth form close connections to nature. It will also give youth the opportunity to form positive relationships with adults, and develop leadership skills that will benefit them throughout their lives. The creation of pollinator gardens will greatly benefit our planet, and improve the lives of those around them.

Chapter Summary

This chapter presented the curriculum framework for the student-centered pollinator program including goals, objectives, essential questions, student understandings, assessment evidence, and learning plan. The chapter was divided into three sections to follow the progression of the pollinator program. The sections are pre-site school visits, a native plant nursery field trip, and post-site school visits. Each section was analyzed with the following elements: student-centered pedagogy, relevant science content, positive youth development, and community engagement via environmental stewardship.

Introduction to Chapter Five

Chapter Five is a reflection of the overall project. I will highlight the main goals and learnings of this capstone. Then, I will revisit the literature review, and reference the three sources that guided me the most. Next, I will assess my accomplishments, challenges, and address the limitations of the project. I will also discuss the next steps that I would do with this project, and offer recommendations for implementing the curriculum. Finally, I will end the chapter with concluding remarks.

CHAPTER FIVE

Conclusion

Chapter overview

In this concluding chapter, I will highlight the main goals and learning of this capstone. I will revisit the literature review, and reference the three sources that guided me the most in achieving the goals of my capstone project. In addition, I will assess my own accomplishments, mention the challenges that I had to overcome, and address the limitations of the project. Furthermore, I will discuss the next steps that I would do with this project, and offer recommendations for the implementation of the pollinator curriculum. I will conclude the chapter with final remarks about the overall capstone project.

Main Goals and Learning

Main goals

The goal of this capstone was to find the means to engage inner city youth in outdoor experiences that would help them form a deep connection to nature. The research question that I focused on was: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? The analysis of the literature review guided me to find one possible answer, to develop and implement a student-centered pollinator curriculum in partnership with national parks, native plant nurseries, and school districts. The curriculum is founded on four elements: student-centered pedagogy, relevant science content, positive youth development, and community engagement in the form of environmental stewardship.

Learning

The process of this capstone reinforced in me a love of teaching youth about nature. The literature review helped me to strengthen my own teaching pedagogy. It also helped me feel more confident as I was contributing my ideas and knowledge to our tri-agency partnership. Forming the partnership was a great learning experience. It helped me keep an open mind and see other people's perspectives on subjects that I am very passionate about.

Furthermore, the literature review helped me identify four important elements that guided me in the development of the pollinator curriculum. The elements are student-centered pedagogy, relevant science content, positive youth development, and community engagement in the form of environmental stewardship. I developed each activity of the curriculum keeping in mind the main qualities of each element. Chapter Four analyzes these elements with examples from the pollinator curriculum. The four elements also helped me to stay focused on the project goals as I was writing the methodology in Chapter Three. This proved to be essential in developing activities that are relevant to the students. When I was researching about positive youth development, I became more aware of the challenges that inner city youth face. This helped me be more sensitive to their needs, which has transformed me into a better educator and mentor. I was inspired to develop a program that could enrich students' lives by incorporating activities that will help them develop leadership skills, improve their community, make positive relationships with adults and classmates, and learn about subjects that they can relate to. I look forward to using this process as I develop other curricula in the future.

Revisiting the Literature Review

In Chapter Two, I focused the literature review on student-centered pedagogical models, place-based education ideologies, community engagement principles, youth development philosophy, and 4th-grade relevant program content in the natural sciences. I will discuss the three sources that guided me the most during this capstone project in the following paragraphs.

Integrated Differentiation and Understanding by Design Model

This model guided me to incorporate important student-centered elements into the curriculum, such as universal program goals, essential questions focused on the learning plan, and self-evaluative measures for the students. “Curriculum should focus on the knowledge, understanding and skill that enables students to develop solid frameworks of meaning in a topic or discipline” (Tomlinson & McTighe, 2006, p.40). This model also gave me ideas on how to incorporate kinesthetic, auditory, tactile, and visual activities that will help students form their own ideas of the core elements of the program.

Most importantly, this model guided me to develop a pollinator curriculum that is meaningful and relevant to the students’ lives. Students will understand that plant, pollinators, and people depend on each other for survival. They will also be active participants of their own learning, which will encourage their curiosity to continue learning about pollinators, plants, and natural areas.

Place-Based Education

The place-based education ideologies helped me develop activities that will help students make deeper connections through experiencing the subjects in real life scenarios.

I was able to highlight local plants, pollinators, and open spaces that the students will continue seeing and visiting throughout their lives. This helped me focus the activities on subjects that are more relevant to the students. Teachers and educators across the nation can use this curriculum as a template. They can highlight the plants, pollinators, and parks that are native to their area, so that the curriculum can be relevant to their students. In doing so, inner city children from different parts of the nation can have amazing experiences in nature and form a deep appreciation for it.

An important principle of place-based education is that students are crucial resources to the community. Students can make differences in their community by working on real-world projects to benefit their local environments (Sobel, 2004, p. 7). The service learning activities during the nursery field trip, as well as the post-site community project are founded on place-based education ideologies. As mentioned before, the pollinator curriculum can serve as a template for other organizations. National parks, state parks, and city parks across the nation can partner with their local botanical gardens, arboretums, or plant nurseries to implement the pollinator program in their area. The service learning activities can vary according to the needs of each organization and the communities they partner with. Inner city youth that participate in the pollinator program, can create green spaces that will benefit not only pollinators, but the entire planet.

Youth Development

The youth developmental philosophies helped me identify specific elements that need to be present in order to create a curriculum that promotes healthy youth development. Those elements include internal and external assets that will help youth

achieve a positive self-image. External developmental assets encompass the youth's support systems, their understanding of their responsibilities and a sense of constructive use of their time; whereas, internal developmental assets comprise youth's personal commitments, values, social competencies, and positive identity (Scales and Leffert, 2004, p.18). Developmental assets play a crucial role in the way youth view themselves and the role they play in society. If inner city youth feel validated by the adults in their lives, they will develop a positive self-image, and will be more open to making closer connections with adults.

The activities of the pollinator program have the potential to help students develop internal and external developmental assets. Students will have a sense of accomplishment and constructive use of their time upon finishing the service learning activities and constructing the pollinator garden in their school. The activities will also help students gain self-confidence, value their surroundings, and contribute to their communities. Students will have positive role models to help them develop leadership skills that will potentially benefit them throughout their lives.

In addition to the sources described above, many of the Hamline courses also inspired this project; classes such as Designing Effective Learning Environments, Environment and Society, Sense of Wonder, Sustainable Foods and Energy Systems, and Linking Communities to Classroom. These classes have helped improve my teaching pedagogy, and inspired many of the lessons that I created for this capstone project. Most of the classes were taken on-line, but the teachers made a great effort to create a sense of long distance community. This gave me the opportunity to also learn and get inspired by my classmates.

Accomplishments

The methodology described on Chapter Three, provided me with a clear plan to follow in order to achieve my goals. Forming a partnership among the Golden Gate National Park rangers, the Golden Gate National Park Native Plant Nurseries, and the San Francisco Unified School District was a key element for the success of this project. The partnership will continue to be vital as we implement the curriculum. I learned a great deal about student needs and the application of relevant content standards from the teachers. They also guided me to apply some of the curricular tools such as prior knowledge assessment, checking for understanding, allowing time to process, self-evaluative measures, and essential questions in ways that resonate well with the students. They revised my teaching materials to ensure that I incorporated kinesthetic, auditory, tactile, and visual activities. The Golden Gate National Park rangers helped me enhance my understanding of place-based education. They will also be an important asset to the program in the future as they will mentor students through the stewardship project both at the nursery and in their schools. I contributed important aspects to the partnership including my ideas and expertise on experiential learning activities related to plants and pollinators, and the skills needed to develop the teaching materials and the student journal.

Another accomplishment was to incorporate four essential elements into the curriculum: student-centered pedagogy, relevant science content to fit school standards, positive youth development, and community engagement in the form of environmental stewardship. As Chapter Four describes, each section of the curriculum emphasizes one or more of these elements.

Challenges

Although the partnership was an accomplishment to celebrate, it proved to be extremely time consuming. Everyone was excited about the project, but it was challenging to accommodate our busy schedules. The three agencies have different protocols to follow in terms of the teaching materials and the student journal. I had to become proficient in accessibility guidelines for the three agencies, and make sure that I honored them in all the teaching materials including the student journal.

Another challenge as the leader of the project was to keep everyone in the partnership focused on the project goals. Everyone was very excited about the curriculum, but at times their input distracted us from the main goals. I wanted to honor everyone's ideas, but doing so often distracted us from the task at hand.

Limitations of the Pollinator Curriculum

One of the main limitations of this project is the fact that I did a curriculum development without implementing the final curriculum. I was not able to see the students using this curriculum, nor was I able to get feedback from them. The curriculum itself does give students the opportunity to give feedback and make suggestions throughout the program, but I think it would have been amazing if students were involved in the developmental stages of the curriculum. I am looking forward to implementing the curriculum, and seeing how it plays out. I am also eager to get input from students and modify the curriculum to better serve their needs.

Another limitation of the pollinator curriculum is that it might not leave room for teachable moments outside the relevant science content. For example, what if a hawk

flies by during the nursery field trip and catches students' attention? The nursery field trip has a packed schedule that imposes time limitations. Hawks are not pollinators. If I decide to talk about hawks, I would have to forgo part of a pollinator lesson. As an outdoor educator, I would be compelled to drop the curriculum and allow students to observe the hawk. I would take full advantage of the presence of this majestic creature, and share with students what I know about hawks. I would encourage their curiosity, and let them have their own time to create new experiences with nature. After all, my main goal is to help students make connections with nature. For all I know seeing the hawk could be a special moment when a young kid makes that life-changing experience.

Next Steps and Recommendations for the Implementation of the Pollinator Curriculum

I am looking forward to implementing this pollinator curriculum, and seeing the students engage in the different activities. As I think of how the curriculum might play out, I want to emphasize important things for teachers and educators to keep in mind as they prepare to launch the program.

Timing of the Program

It will be important for teachers to time the program in a way that allows students to plant the garden and see it grow during their school year. The timing might be different in some areas to accommodate for extreme weather conditions. I recommend that the pre-site lessons and nursery field trip happen during the beginning of the school year, which means either late summer or early fall. In states with temperate weather like California, students can plant the pollinator garden in late fall, and take advantage of the rainy winter season that will help the plants grow. In states with extreme winter conditions, students

can start seedlings indoors while they wait for spring to arrive. They can make mini greenhouses by using small containers that can be covered with plastic wrap.

Weather Conditions

If it is a rainy day, it will be very unlikely that students will see pollinators in the garden. I would recommend having taxidermy specimens available for students to observe. This might prove to be very useful even when the weather is nice. Students can take a closer look at the pollinators, and then observe them in the garden. Having access to taxidermy specimens will be a great enhancement to the program.

Hot weather conditions can also pose a challenge. Students might not be as excited to be outdoors. During any outdoor activities, it will be very important to make sure that students are dressed appropriately, that they have access to sun hats, sunblock, and that they drink plenty of water. Teachers and students should take water breaks together to encourage all students to stay hydrated.

Different Groups of Students

I have been reflecting about teaching this curriculum to students who are English language learners. The Bay Area of San Francisco has a high number of immigrants from all around the world. It will be very challenging to translate the curriculum into all the languages that are spoken by every student. But there are many things that can be done to guide students through the curriculum. I have found from experience that best practices to engage students learning English are through visuals aids that are simple and teach key words of the program. Another technique is to teach new words by doing the action of the word. Learning the key words of the program in the students' languages, and involving the rest of the class will also help keep everyone engaged.

Inner city students that have never been surrounded by nature might feel uncomfortable and even unsafe in open areas. It will be vital to prepare them well during the pre-site school activities. For example, if students are scared of bees, teachers and park educators can approach this challenge by recognizing the reasons that make students afraid, and address ways in which they can be safe around bees. Park educators can also clarify any misconceptions that students might have about the national park they will visit.

Teachers and park educators need to make sure that all students feel included, specifically students that have physical challenges or any disabilities. Teachers should inform park educators beforehand of any special accommodations that need to be addressed. Students with specific needs should never be singled out; instead, park educators should modify the program in a way that intentionally includes everyone. For example, if a student has a visual disability that requires a journal with larger print, all students should have journals with large print.

Student Safety

As with all education programs, it is important to keep in mind the safety of all students throughout the different activities, especially when students are in the garden. If students are allergic to bees, teachers and park educators will need to take necessary precautions. Nursery staff must monitor the garden on a regular basis for wasps' nests, which are often found underground. They are not hard to spot. Usually one can see multiple wasps coming in and out of their nest. If found, proper removal should take place before bringing students to that particular area of the garden.

Park educators will need to introduce students to the proper use of garden tools

before starting any garden activity. Adult chaperones and teachers can help students follow safety guidelines by modeling proper behavior. Laminated cards with visuals will help students remember tool safety protocols. Students can take turns to remind the rest of the class about safety practices. They will need to be experts in this area when they lead the planting day at their school garden.

Involving all Grades

The pollinator garden can provide amazing benefits for the entire school. Each grade can contribute something to the garden so everyone can take ownership of the space. Older students can do a phenology project and monitor the plants and pollinators during the different seasons of the year. Students in art classes can create murals, and colorful paths throughout the garden. Students learning about poetry can make signs of their favorite poems. Students learning about natural sciences can create interpretive signs about plants, insects, animals, and healthy ecosystems. Students in woodshop class can help create a gathering circle with logs and short stools, and the younger students can help decorate them. The garden can become a gathering place, give inspiration to art class projects; be a venue for dance class, music class, poetry lessons, and story-telling. The school can celebrate Earth Day, and other festivities in the garden.

Involving Parents, Legal Guardians, and other Family Members

The pollinator garden can also provide a great gathering space for the students' families. A great way to involve them is to have on-going volunteer days where adults and siblings help tend the garden. This can also give parents, legal guardians, siblings, and other family members a great opportunity to both learn and share their knowledge regarding plants and how to tend them. In California, many inner city schools have

students whose parents are migrant workers. Some have great knowledge about cultivating plants, and tending to gardens. This would give those families a great way to honor some of their traditions and recognize their knowledge.

I have a wonderful memory of a chaperone captivating the students' attention with his amazing stories. We were observing a Monarch butterfly in the garden. The students were very excited to witness the playful nature of the butterfly. I mentioned that Monarch butterflies in the Eastern side of the United States migrate to the state of Michoacán in Mexico. Then one of the students said with such enthusiasm, "That is where we are from!" Her uncle then shared stories about the sanctuaries in Mexico where the butterflies roost over the winter. The students were extremely engaged. All the Spanish-speaking students took turns translating the stories into English for the rest of the class. The lesson became an amazing cultural experience. Moments like this can greatly help youth see the assets that their families and they contribute to the community.

Conclusion

The goal of this capstone project was focused on finding a tangible way to engage inner city youth in nature. The research question that I investigated was: how can national parks, native plant nurseries, and school districts work together to inspire inner city youth to become active stewards of the natural world? The analysis of the literature review on Chapter Two helped me find one possible answer: to develop and implement a student-centered pollinator curriculum that is founded on four elements, which include student-centered pedagogy, relevant science content, positive youth development, and community engagement in the form of environmental stewardship. Another important aspect of the answer to the research question is the formation of a partnership among national park

rangers, native plant nursery educators, and school district officials. Chapter Three presented the plan that I followed in order to develop the student-centered pollinator curriculum, and Chapter Four described the curriculum in detail.

The curriculum that I created provides an interactive way for students to explore the relationships among plants, people, and pollinators through hands-on activities in their classrooms and in a national park. The pollinator program engages students in fun visual and kinesthetic activities that honor student-centered pedagogy and relevant science content. Activities such as the California poppy costume dress up skit, the four-square vocabulary activity, and the pollination investigation in the garden will give students a chance to move around and interact in role play. The activities will also help students visualize concepts through games, and might help them understand the material better by making important connections with the natural world.

The service learning activity during the nursery field trip and the school pollinator garden project honor the principles of youth development and community engagement. Throughout the program the students' perspectives will guide the discussions. Their neighborhoods and experiences will be viewed as assets to the program. This will help students form a positive image of themselves, and value their communities. Students will be active participants in real life projects. Students will be able to see for themselves that their contribution is important to maintain healthy habitats in a national park and in their communities. They will also understand that they are directly helping plants and pollinators. By designing and planting a pollinator garden, students will have a clear understanding of their roles and responsibilities, and will exercise their leadership skills. They will also have a sense of accomplishment and constructive use of their time, which

will help them gain internal and external developmental assets. “Building a love of nature and an interest in working to conserve natural resources all starts with having fun outdoors” (Hower, Mac Glash, and Wader Lase, 2012, p. 9).

At the end of the program, students will feel accomplished and will have closer connections to pollinators as they see them visiting the habitat they help create in their pollinator garden. Throughout this program, the subject of pollination will have a continuing meaning for the students’ personal lives. They will have learned the science standards by experiencing nature, and by being active participants in their learning.

I believe that this student-centered pollinator curriculum provides a unique opportunity to reach youth across the nation. It can help inner city children experience the magic of nature, and form a deep appreciation for it. National parks, state parks, city parks, native plant nurseries, botanical gardens, and arboretums can work with their local school districts to implement the program in their area. A program like this has the potential to strengthen communities by helping inner city youth appreciate their surroundings. It will also give youth the opportunity to develop leadership skills that will benefit them throughout their lives. The creation of pollinator gardens will greatly benefit our planet, and improve the lives of those around them.

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Appendix A

Student Assessment Rubric

Criterion	Not Present (0)	Needs Improvement (2)	Satisfactory (4)	Outstanding (6)
Knowledge of subject	Student does not know anything about the subject.	Student knows basics of subject.	Student has firm grasp of the subject matter.	Student is knowledgeable on the subject and understands different the complexities of it. Considers different points of view.
Following directions	Student does not follow given directions.	Student needs to improve in following directions.	Student follows directions.	Student follows directions, and is well organized.
Participation	Student does not participate.	Student participates less than five times.	Student participates more than five times.	Student participates numerous times, and clearly conveys his or her opinions and understandings on the subject.
Active listening	Student does not listen to others and is disruptive when others participate.	Student does not engage but does not disrupt the class.	Student listens to other comments, and asks for clarification when needed.	Student listens to others, and makes connections of the new ideas. Student asks for clarification when needed, and contributes his or her new ideas.
Connections and Reflection	Student does not make connections of the material and reflections are not genuine.	Student makes cursory connections and reflections with the material.	Student presents clear connections between the material and class activities. Student makes adequate reflections on most of the material.	Student clearly articulates connections between the material and the different class activities. Student also makes clear connections of his or her personal life by presenting thoughtful and authentic reflections.
Seeks further understanding	Student does not ask for guidance when needed.	Student only asks questions when prompted to.	Student asks further questions on the subject.	Student asks further guidance and questions on the subject. Student conducts his or her own investigation on the subject.

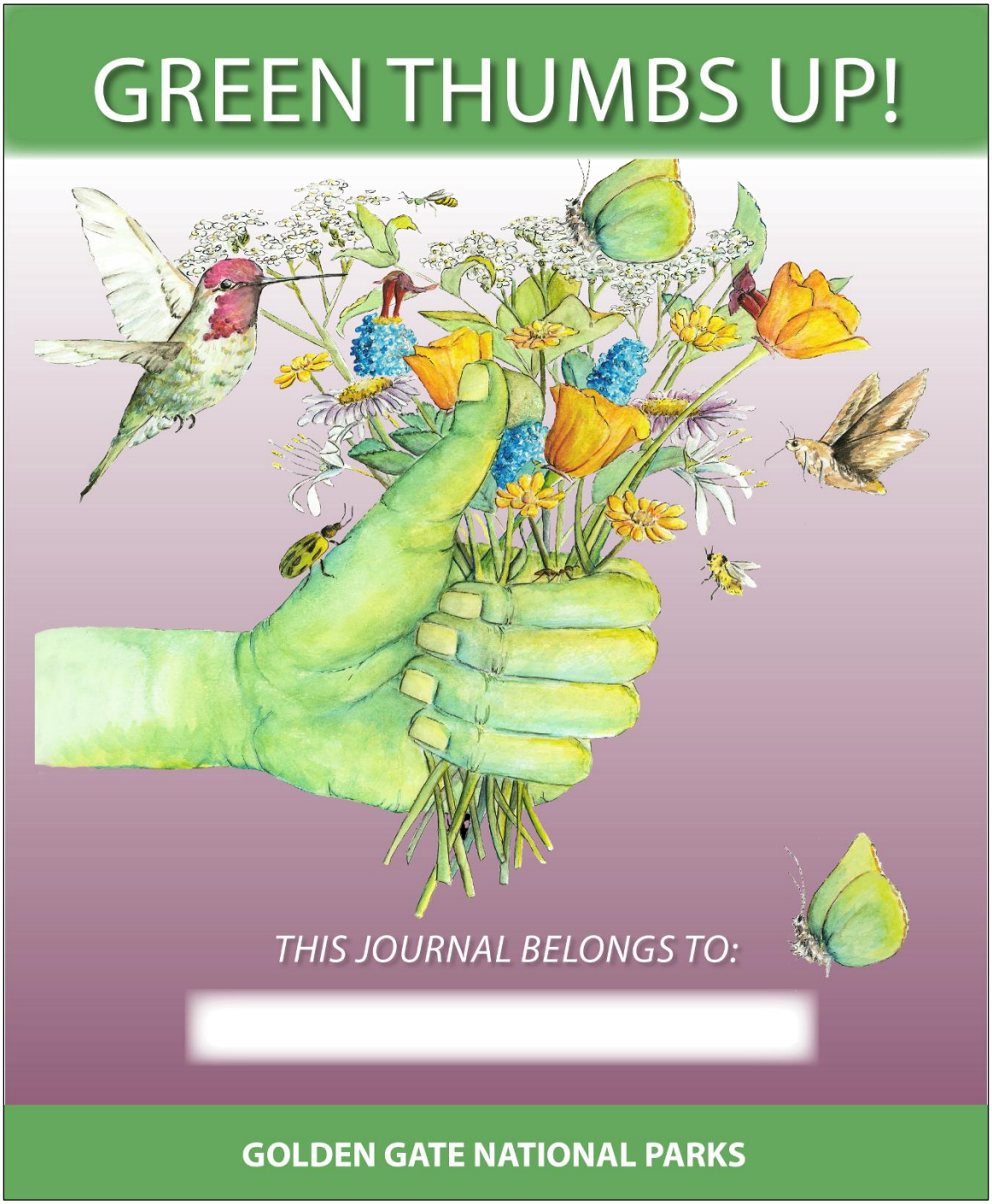
Appendix B

Student Self-Assessment Rubric

Attribute	Needs Improvement	Room to Grow	Excellent Work
I understand the material			
I followed directions			
I participated in group discussions			
I completed the student journal			
I made connections between the material and the different activities			

Appendix C

Student journal



WELCOME TO GREEN THUMBS UP!

Soon you and your classmates will visit the Golden Gate National Parks. You will study many interesting plants and learn about pollination.

Before you can explore the park, you will need to get ready. Go to the next page to start your journey...

Which parks are in my neighborhood?

What do I like to do in the parks that I visit, or that I will visit?

What do I know about national parks?

Which national parks have I heard of?

Who lives in a national park?

Who do national parks belong to?

After watching the slideshow...

Do you have any questions about the native plant nursery? Do you have any other general questions ?

What would you like to see at the native plant nursery? You may draw, write, or make a short song about it.

Vocabulary Activity

Definition

Drawing

Sentence

Example

Choose your favorite word from the vocabulary activity and define it in your own words:

How does this word relate to the native plant nursery? You may draw or write your answer.

After watching the pollinator video, draw a flower and label its different parts. Explain how each flower part is related to pollination.

Essential Questions

How do pollinators, plants, and people help each other?

What do you think would happen if pollinators disappear from our planet?

What can you do about it?

Pollinator Rubric

Fill in pollinator features and their preferred flower features.

Pollinator	Illustration	Sense of smell or vision
Anna's hummingbird		
Ant		
California bumble bee		
Green hair streak butterfly		
Green metallic bee		
Moth		
Spotted cucumber beetle		

Shape of flower	Size of flower	Color of flower

Welcome to the Native Plant Nursery!

Native Plant Nursery Tour

Describe your favorite part of the native plant nursery tour.

Build Your Own Pollinator Activity

Draw or write a story about the pollinator you designed.

Nursery Stewardship Activity

What does stewardship mean to you?

Reflect on the work that you and your classmates accomplished during your service activity. Please clearly state in form of a poem, short story, or drawing your unique contribution to the native plant nursery.

How does your stewardship activity help pollinators?

What stewardship activity would you like to do in your own community?

Vocabulary

Adaptation: special features or behaviours that help living things survive in their environment.

Camouflage: adaptation of blending into an environment.

Flowers: the blossom of a plant that contains sepals, petals, stamens (pollen), and pistil. Flowers will produce seeds if they are pollinated.

Habitat/ecosystem: a community of organisms interacting within a given physical environment. The natural home of a plant or animal.

Indigenous: originating or occurring naturally in a particular place; native.

National Park: an area of special scenic, historical, or scientific importance set aside and maintained by a national government and the community.

Plant cycle: the different steps a plant goes through as it grows from seed to adult plant to flower to seed.

Plants: living organisms that make their own food and convert carbon monoxide into the oxygen we breathe. Plants are composed of many parts such as roots, stem, leaves, flowers, fruits, and seeds.

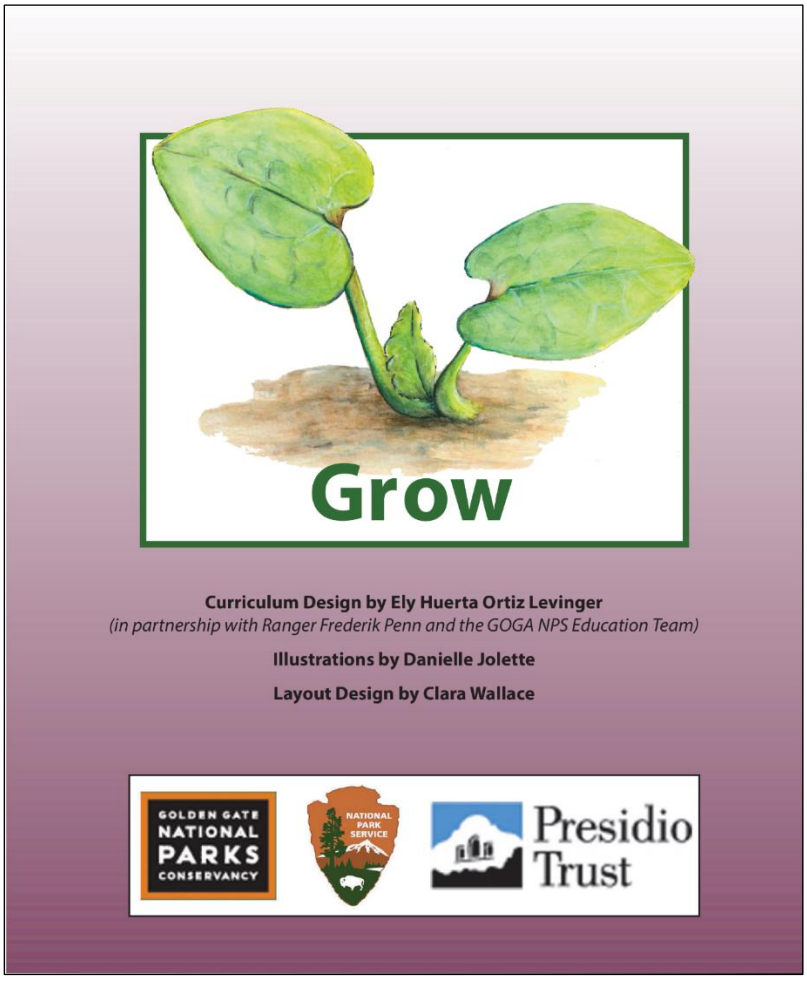
Pollination: the process of transporting pollen grains from the stamen to the pistil of a flower so a plant can make seeds.

Pollinators: anything that helps transfer pollen from the stamen to the pistil of a flower. Examples: bats, birds, insects, and wind.

Stewardship: to take care of something we value like our home, school, or a natural area. When we become stewards, we take responsibility and contribute our time, talent, and positive energy.

My Community Stewardship Project


Remember to always…
Explore
Observe


Grow
Curriculum Design by Ely Huerta Ortiz Levinger
(in partnership with Ranger Frederik Penn and the GOGA NPS Education Team)
Illustrations by Danielle Jolette
Layout Design by Clara Wallace
GOLDEN GATE NATIONAL PARKS CONSERVANCY
NATIONAL PARK SERVICE
Presidio Trust

Appendix D

California native pollinators and plants

Green Hairstreak Butterfly

Callophrys rubi

Green Hairstreak Butterfly

Butterflies like flowers that have...

Smell	Color
Flowers that have a sweet smell	Flowers with petals that are bright, usually red or purple
Shape & Size	**Nectaries**
Flowers that are shaped like a tube	Flowers that have a lot of nectar with lots of sugar

- Butterflies have wings that are an iridescent (shiny and rainbow-like) green color.
- The butterflies eat nectar and lay their eggs on plants.

Seaside Daisy

Erigeron glacus

Seaside Daisy

About the Flower...

Smell	Color
Flower has a faint fragrant smell.	Flower has purple petals and yellow centers.
Shape & Size	**Nectaries**
Flower is shaped like a disc.	Flower has a lot of nectar with lots of sugar.

- Each flower is made up of many tiny, individual flowers.
- These flowers are found near the beach.

California Bumblebee

Bombus Californicus

California Bumblebee

Bumblebees like flowers that have...

Smell
Flowers that have a fresh or mild smell

Color
Flowers with petals that are yellow or blue with ultra-violet nectar guides

Shape & Size
Flowers that are flattened or disc shaped

Nectaries
Flowers that have a lot of nectar

- Bumblebees rely on infrared guides to find nectar.

Infrared that a bee sees

California Poppy

Eschscholzia californica

California Poppy

About the Flower...

Smell
Flower has a faint fragrant smell.

Color
Flower has petals that are yellow with orange centers.

Shape & Size
Flower is shaped like a cup.

Nectaries
Flower has nectar.

- The poppy is the California state flower.
- Native Americans would eat poppy flowers and leaves.

Anna's Hummingbird

Ensifera ensifera

Anna's Hummingbird

Hummingbirds like flowers that have...

Smell	Color
Flowers that have a sweet smell. But, hummingbirds do not rely on sent to find flowers.	Flowers with petals that are bright: red, orange or white
Shape & Size	**Nectaries**
Flowers that are shaped like a tube	Flowers that have a lot of nectar with lots of sugar

- Hummingbirds eat both nectar and bugs.
- Hummingbirds build permanent homes far away form other hummingbirds.

Twinberry

Lonicera involucrata

Twinberry

About the Flower...

Smell	Color
Flower has a faint fragrant smell.	Flower has petals that are red with yellow edges.
Shape & Size	**Nectaries**
Flower is shaped like a tube. Flowers grow in pairs.	Flower has nectar.

- The flowers are somewhat hairy.
- The plant produces berries; but we can not eat them because they are poisonous.

Metallic Green Bee

Agapostemon texanus

Metallic Green Bee

Metallic Green Bees like flowers that have...

Smell	Color
Flowers that have a fresh or mild smell	Flowers with petals that are yellow or blue with ultra-violet nectar guides
Shape & Size	**Nectaries**
Flowers that are large and shaped like a disc	Flowers that have a lot of nectar

- The bees bodies are green and iridescent (shiny and rainbow-like).
- They are sometimes called sweat bees because they are attracted to human sweat.

Coast Blue Blossom

Ceanothus thyrsiflorus

Coast Blue Blossom

About the Flower...

Smell	Color
Flower has a faint fragrant smell.	Flower has petals that are deep to light blue.
Shape & Size	**Nectaries**
Flower is shaped like a cup. Flower is small and grouped in clusters.	Flower has nectar.

- The leaves or flowers can be crushed and added to water to make soap.

White-lined Sphinx Moth

Erinnyis obscura

White-lined Sphinx Moth

Moths like flowers that have...

Smell
Flowers that have a strong sweet smell at night

Color
Flowers with petals that are pale: mauve, lavender, pink and white

Shape & Size
Flowers that are shaped like a tube

Nectaries
Flowers that have a lot of nectar

- Moths usually fly at dawn and dusk, but they can also fly during the day.

Soap Root

Chlorogalum pomeridianum

Soap Root

About the Flower...

Smell
Flower has a faint fragrant smell.

Color
Flower has petals that are white.

Shape & Size
Flower is shaped like a cup.

Nectaries
Flower has nectar.

- The flowers open in the evening and close by morning.
- Native Americans used the root of the plant to make soap.

Western Spotted Cucumber Beetle

Diabrotica undecimpunctata

Western Spotted Cucumber Beetle

Cucumber Beetles like flowers that have...

Smell	Color
Flowers that can smell fruity, spicy or similar to decaying material	Flowers with petals that are grey or off-white in color
Shape & Size	**Nectaries**
Flowers that are large and shaped like a bowl or flattened	Flowers that do not produce nectar

- The beetles eat flower petals, pollen and leafs.
- Farmers see beetles as pests, because the beetles eat their crops.

Buttercup

Ranunculus californicus

Buttercup

About the Flower...

Smell	Color
Flower has a faint fragrant smell.	Flower has yellow petals.
Shape & Size	**Nectaries**
Flower is flat and shaped like a disc.	Flower has nectar.

- The buttercup grows near the beach.
- *Ranunculus* is Latin for "little frog".

False Honey Ant

Prenolepis impairs

False Honey Ant

Ants like flowers that have...

Smell	Color
Flowers that smell slightly sweet	Flowers with petals that are a variety of colors
Shape & Size	**Nectaries**
Flowers that are small and close to the ground	Flowers that have some nectar

- Ants are not usually out in the summer when it is hot. The ants like winter when it is cool.

Yarrow

Achillea millefolium

Yarrow

About the Flower...

Smell	Color
Flower has a strong sweet smell.	Flower has white petals.
Shape & Size	**Nectaries**
Flower is small and shaped like a disc.	Flower has nectar.

- Native Americans used yarrow for its medical properties to slow bleeding and kill bacteria.

Appendix E

School pre-site visit lesson plans

Fig. 4. School Pre-site Visit: Park Staff Facilitated Classroom Lesson	
Time: 90 minutes	**Materials:** 1. Student journals. 2. national park Centennial video from NPS website. 3. California poppy costume and pollinator puppets. 4. Pollination video.
Intro: 15 minutes	<u>Welcoming remarks:</u> • Park educators welcome the students and introduce themselves. • Park educators review the safety rules, and set clear student expectations. • Students engage in an ice breaker game. • Park educators learn students' names.
Activity One: 15 minutes	<u>Prior knowledge and review of national parks (journal pages 3 & 4):</u>  • On page 3 of their journal, students write down the parks they know in their neighborhood, and the different activities that they like to do at those parks.  • Park educators introduce the concept of national parks and help students gain a better sense of the national park they will visit. • Students watch the national park Centennial video: https://www.nps.gov • Students write in their journals what they know about national parks.
Activity Two: 20 minutes	<u>California poppy costume and pollinator costume activity:</u> • Students engage in a pollinator costume play as they help dress one of their classmates in a California poppy costume. • Students review the different parts of a plant as they talk about the plant life cycle. • Students also make connections of what plants need to survive, and relate those concepts to the different parts of the plant. • Students interact with the pollinator puppets and talk about their characteristics.
Activity Three: 10 minutes	<u>Short pollination film:</u> • Students watch a 5-minute pollination video **Louie Schwartzberg : The Hidden Beauty of Pollination** http://www.ted.com/talks/louie_schwartzberg_the_hidden_beauty_of_pollination/transcript?language=en This is a time-lapse video of close up shots of pollinators and flowers. • Students share their highlights of the video.
Activity Four: 15 minutes	<u>Essential questions introduction:</u> • Students divide into small groups and review the essential questions. • Park educators allow students to guide the conversation. *What would happen if pollinators disappeared from our planet?* *How would the disappearance of pollinators affect your personal life?* *What could you do to help pollinators?*
Activity Six: 15 minutes	<u>Meaning of Stewardship:</u> • Park educators ask students what stewardship means. They allow students explore their own understanding of stewardship and have a discussion on the subject. • After students share their thoughts on the word stewardship, park educators ask them: *What do you like to take care of?* Park educators allow students to make the connections between stewardship and the things they like to take care of.

<table>
<tr><th colspan="2">Fig. 5. School Pre-site: Teacher Facilitated Classroom Lessons</th></tr>
<tr><td>Time:

90 minutes</td><td>Materials:
1. Student journals.
2. Four Square vocabulary guidelines.
3. Pollination video.
4. Pollinators and California native plant cards.</td></tr>
<tr><td>Intro:

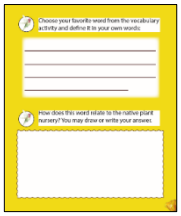
15 minutes</td><td>• Students share their highlights of the park educator lead activities.
• Teachers guide students in a discussion of their understandings of the program and assess student needs.
• Students give further feedback to teachers about their needs and propose changes to the program according to their unique styles of learning.
• Teachers share that information with park educators.
• Teachers review student expectations, and introduce assessment guidelines.
• ABCDEs guidelines for scientific sketching exercises: A-accuracy, B-big, C-clear, D-Detailed, E-Explanation
• Students propose additional methods to be evaluated.</td></tr>
<tr><td>Activity One:

20 minutes</td><td><u>Four Square Vocabulary Activity (journal pages 6 & 7):</u>
 

• Students choose a vocabulary word and write it in the middle of the page.
• The vocabulary word is surrounded by four squares. The squares are assigned one of the following: write a definition of the word, draw a picture of the word, write a sentence using the word, and write an example of the word.
• After filling out one of the boxes of their choosing, students walk around the classroom and their classmates to fill out the rest of the squares so that each student has the opportunity to think of at least four words.

• Teacher debriefs the activity by going over the vocabulary.
• Teacher assesses student needs and helps clarify vocabulary words.

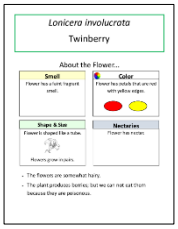
Vocabulary words (also found on pages 18 and 19 of student journal):
Adaptation: special features or behaviors that help living things survive in their environment.
Camouflage: adaptation of blending into an environment.
Flowers: the blossom of a plant that contains sepals, petals, stamens (pollen), and pistil. Flowers will produce seeds if they are pollinated.
Habitat / ecosystem: a community of organisms interacting within a given physical environment. The natural home of a plant or animal.
Indigenous: originating or occurring naturally in a particular place; native.
national park: an area of special scenic, historical, or scientific importance set aside and maintained by a national government, and the community.
Plant cycle: the different steps a plant goes through as it grows from seed to adult plant to flower to seed.
Plants: living organisms that make their own food and convert carbon monoxide into the oxygen we breathe. Plants are composed of many parts such as roots, stem, leaves, flowers, fruits, and seeds.
Pollinators: anything that helps transfer pollen from the stamen to the pistil of a flower. Examples: bats, birds, insects, and wind.
Stewardship: to take care of something we value like our home, school, or a natural area. When we become stewards, we take responsibility and contribute our time, talent, and positive energy.

 
• Students turn to page 7 and describe a vocabulary word of their choosing, and relate that word to the native plant nursery.</td></tr>
<tr><td>Activity Two:

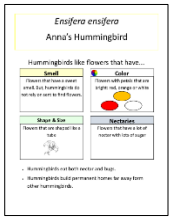
20 minutes</td><td> 

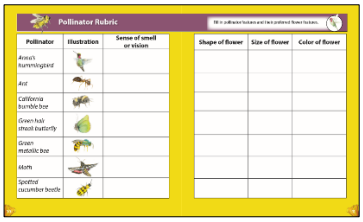
<u>Short pollination film and discussion on pollination (journal page 8):</u>
• Students watch two pollination videos, and are encouraged to watch extra videos in their preferred language.
Video 1: Meet the Natives: Can Wild Bees Also Pollinate Our Plants and Crops?
http://thekidshouldseethis.com/post/59594519508
Students learn about native bee populations and different ways we can support them.
Video 2: Life Story of the Black Swallowtail Butterfly trailer
https://www.youtube.com/watch?v=lZUZK_mowmc
From egg, to caterpillar, to chrysalis, to adult. This documentary was filmed in a garden and along the seashore of Gloucester, Massachusetts.</td></tr>
</table>

<table>
<tr><th colspan="2">Fig. 5. School Pre-site: Teacher Facilitated Classroom Lessons</th></tr>
<tr><td></td><td>• Students demonstrate their understanding of pollination by explaining how each flower part is related to pollination on page 8 of their journal.</td></tr>
<tr><td>Activity Three:
15 minutes</td><td><u>Essential questions review (journal page 9):</u>
 
• Students divide into small groups and review the essential questions.
• Teachers allow students to guide the conversation.</td></tr>
<tr><td>Activity Four:
30 minutes</td><td><u>Pollinators and California native plants (journal pages 10 & 11)</u>:
• Students review the principles of adaptations as it refers to plants and pollinators.
• Teacher introduces the concept of form and function.
• Students break up into small groups, and each group receives a set of cards containing California native plants, and 7 pollinators.
• Each student chooses a picture of a California native flower that they like.
 

• Students match the flower to its pollinator based on their understanding of form and function.
 

• Teacher debriefs activity by encouraging students to have an open discussion of flower and pollinator relationships.
• Students revise their answers of the matched California native plants with their pollinators.
• Students work on the pollinator rubric on pages 10 and 11 of their journal.
 
</td></tr>
<tr><td>Reflection:
20 minutes</td><td><u>Student assessment:</u>
• Students reflect on new ideas learned, and ask further questions about the material they are learning.
• Teachers evaluate students' progress, and make note of changes needed in order to accommodate all student needs.
• Students evaluate their own work and revise their understandings of the material.</td></tr>
</table>

Appendix F

Native plant nursery field session lesson plan

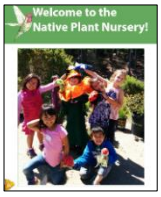
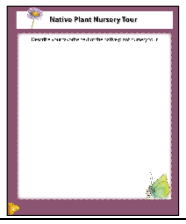
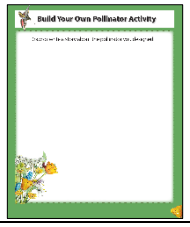
	Fig. 6. Native Plant Nursery Field Session
Time: 3 hours	**Materials:** 1. Student journals. 2. Pollinator's box: pollinator finger puppets, magnifying glasses, colorful pipe cleaners, construction paper, scissors. 3. Stewardship tools.
Intro: 15 minutes	<u>Investigating Plant-Pollinator Relationships at the Native Plant Nursery:</u> • Park educators welcome the students. Review safety rules and student expectations.  • Students engage in a fun sense of place ice breaker game. • Students are divided into three groups. • Each group rotates through the following activities: ○ nursery tour, ○ pollinator investigation, and ○ service learning. • Students will break for a 25-minute lunch during their regular time.
Activity One: 40 minutes	<u>Nursery tour and review of concepts (journal page14):</u>  • Students share their prior knowledge regarding plants and plant adaptations. • Students engage in a nursery tour and review further the concepts of the plant life cycle and plant adaptations. • Students use microscopes to make close observations of flower parts. • Students record their observations on page 17 of their journal.
Activity Two: 40 minutes	<u>Pollinator investigation in the Habitat Demonstration Garden (journal page 15):</u>  • Students head out to the Habitat Demonstration Garden to gather observations. They will be able to use their senses to make specific observations of plant and pollinator interactions. • Students create a 3-D model of their own flower-pollinator based on form and function principles. • Students draw or write a story about their pollinator on page 16 of their journals. • Park educator debriefs activity by gathering the student in a circle and asks them to share their flower-pollinator models. • Students reflect on the different ways in which pollinators help our food systems.
Activity Three: 40 minutes	 <u>Service Learning (journal pages 16 and 17):</u> • Park educators introduce the service learning activity, and emphasize on its importance. • Students engage in a service learning activity that will help the native plant nursery reach its growing goals. • Activities vary according to the season and needs of the nursery. Activities include: transplanting, out-planting, pot washing, or seed cleaning. Priority should be given to plant in the garden if weather and nursery needs allow it. • After their service learning activity, students turn to page 14 of their journals and reflect on what stewardship means to them, and on their contribution to the native plant nursery.

	Fig. 6. Native Plant Nursery Field Session
	 • On page 15 of their journal, students relate their stewardship accomplishments to helping pollinators. • Students are think of a stewardship project to do in their communities.
Student Reflection: 10 minutes	• Students reflect on the different activities they engaged during their field trip. • Students relate their connections to the program goals and to their personal lives. • Students write any additional observations on their journals.

Appendix G

School post-site visits lesson plans

<table>
<tr><th colspan="2">Fig. 8. School Post-Site Visit: Park Educators Facilitated Classroom Lessons</th></tr>
<tr><td>Time:
3 hours</td><td>Materials:
1. Student journals.
2. Computers and access to internet, or access to a library.
3. The path of friends, flowers, and food Matching Game.
4. Burpee’s Bee Garden package.</td></tr>
<tr><td>Intro:
20 minutes</td><td><u>Welcoming remarks:</u>
• Park educators greet the students.
• Park educators review the safety rules, and student expectations.
• Students share something they learned during the nursery field trip.</td></tr>
<tr><td>Activity One
20 minutes</td><td><u>Story writeup:</u>
• Students create a story about stewardship in a garden or about the interconnections among plants, pollinators, and people.</td></tr>
<tr><td>Activity Two:
90 minutes</td><td><u>Research and planning:</u>
• Students divide into smaller teams and set clear goals.
• Students take on leadership roles according to their goals.
• Students use technology to research further on pollinator gardens.
• Students plan a pollinator garden following guidelines for California native plant gardening as well as pollinator gardening.
• As part of the planning process, students contact appropriate school staff to acquire permits, or to make further connections to help them in their pollinator garden planning.
• Students design a garden maintenance plan in order to provide upkeep for the garden throughout the school year.
Students use the Pollinator Partnership curriculum (www.pollinator.org) as a resource.</td></tr>
<tr><td>Activity Three:

30 minutes</td><td><u>Pollinator garden plan (journal pages 20 and 21):</u>
• Students present their plan for developing the pollinator garden.
 

• Park educators and teachers guide students to solve any foreseen challenges.
• Students evaluate their own work, and make appropriate changes to their plans.</td></tr>
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Fig. 8. School Post-Site Visit: Park Educators Facilitated Classroom Lessons	
Conclusion: 20 minutes	• Students share highlights of new concepts learned, and review their goals. • Students relate their goals to the essential questions of the program.

Fig. 8. School Post-Site Visit: Park Educators Facilitated Classroom Lessons-Part 2	
Time: 3 hours	**Materials:** 1. Student journals. 2. Pollinator plants provided by native plant nursery. 3. Soil provided by either the school or native plant nursery. 4. Planting tools provided by native plant nursery.
Intro: 30 minutes	<u>Welcoming remarks:</u> • Park educators greet the students. • Park educators review the safety rules, and student expectations. • Students introduce the plans for the planting day. • Students review their goals and relate them to the essential questions of the program.
Activity One: 90 minutes	<u>Planting day:</u> • Students lead the planting day with help from park educators and teacher. • Students assign leadership roles to each other and lead the planting of the pollinator garden. • Students keep records of native species planted.
Activity Two: 30 minutes	<u>Garden maintenance implementation plan:</u> • Students establish plant watering schedules and garden maintenance logs based on their own research. • Park educators offer students further guidelines for plant maintenance. • Students work as a team each week to accomplish garden maintenance goals.
Reflection: 30 minutes	• Students reflect on their goals accomplished, and talk about any challenges that need to be addressed. • Students connect their accomplishments to the essential questions and goals of the program. • Park educators and teachers emphasize on the contributions that students made to the national parks, their school, and their community. • Students evaluate their own work, add additional notes on their journals, and make any needed changes based on their new understandings.
Ongoing projects:	1. Students perform a phenology project of their school garden by observing the garden once a week for 15 minutes and record their observations. They offer explanations and predict developments. 2. Students propose a service project for their communities, and work together to accomplish it with guidance from teachers and park educators.